American Machinist

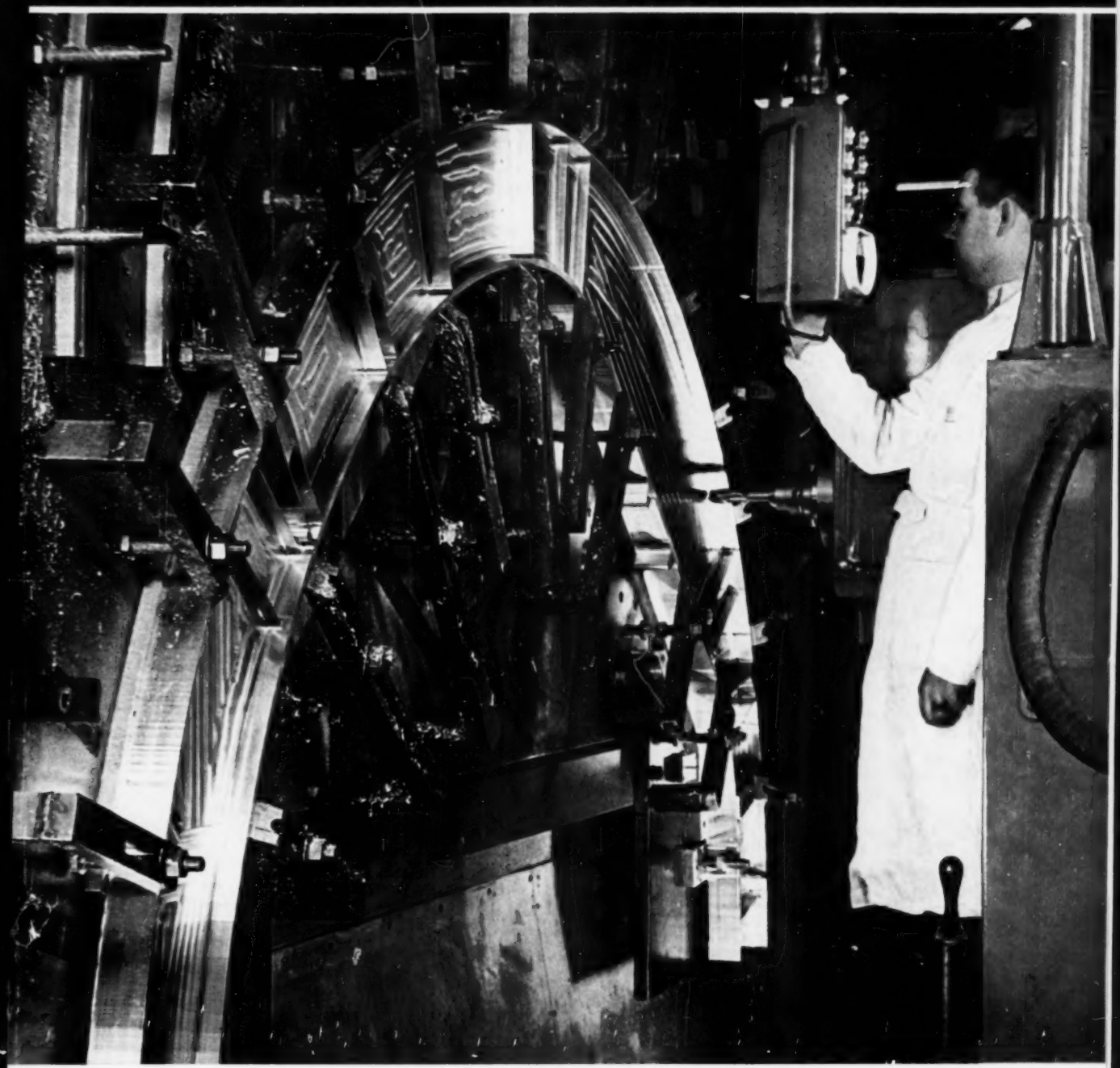
JUNE 29, 1959 75¢

McGRAW-HILL MAGAZINE OF METALWORKING PRODUCTION

New Technique:

ROLL EXTRUSION

see page 84



Tape controls 3-axis milling for Atlas missile—see page 94

HEALD AUTOMATED LINE performs

171 OPERATIONS

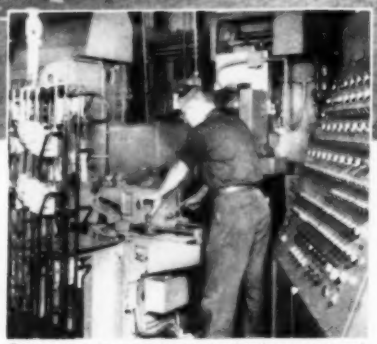
Two identical 39-station Bore-Matic transfer lines drill, bore, ream, tap, face, probe and gage 48 bores and 5 side faces of transmission valve bodies

REPRESENTING the ultimate in straight-line automation, these Heald Model S Bore-Matic transfer lines are speeding the precision production of valve bodies at one of America's leading automotive plants.

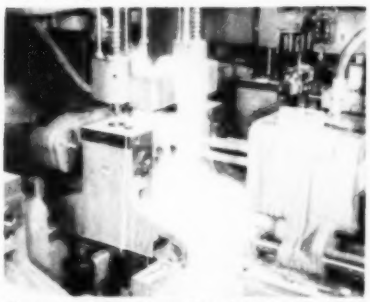
Each line consists of two 50-foot sections — a 19-station section for the small-bore and semi-finish facing operations and a 20-station section for core drilling, reaming and finish facing. A total of 171 operations (112 machining, 52 probing and 7 air gaging) are performed in a fully automatic palletized transfer line with a cycle time of 13 seconds for each station.

Compared to previous methods, the new Heald system results in less handling and locating of parts, fewer rejects, greater efficiency and substantially lower production costs.

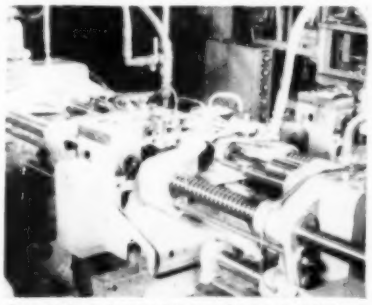
For complete information on this interesting installation, send for a copy of the February 1959 issue of The Heald Herald.



Parts come to machine on overhead conveyor and are semi-automatically loaded onto the transfer pallets. Push button control console for all stations is shown at right.



Tapping and drilling operation at Station 12 of Section 1. Probing station is shown in the background.



Core drilling of spool bores at Station 4 of Section 2. Bores are then semi-finish and finish reamed and air gaged for diameter.

HEALD

IT PAYS TO COME TO HEALD!

THE HEALD MACHINE COMPANY

Subsidiary of The Cincinnati Milling Machine Co.

Worcester 6, Massachusetts

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American Machinist
McGRAW-HILL MAGAZINE OF METALWORKING PRODUCTION

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TURN PAGE FOR METALWORKING REPORT →

METALWORKING REPORT

SIGNIFICANT CURRENT DEVELOPMENTS IN TOOLING AND PRODUCTION PROCESSES

CUTTING

Jet Machining

The efforts to machine hard materials with a liquid jet (AM—May 18, '59, p146) are being actively pushed by an aircraft company. Based on the fuel injection system of diesel engines (where a jet stream wears a hole in the block), a modified and boosted diesel injection system is used to put holes in sheet metal. Principal problems center on the hazards of high velocity and getting sufficient control to hold tolerances. As soon as more specific results are available they will be reported.

"Flat" Means Flat

Within five millionths, according to Buick specs on water-pump impellors—and this precision is reached at high production. The parts are honed, then checked at one of the few monochromatic-light optical-flat setups on a production line. The gasket-sealing face is tested at 25 psi for leaks, but because of the high precision, no rejects have been reported due to poor sealing. According to the company, the water-pump impellors are the most accurate flat parts in the car. See p79.

Slugging on Bar Machines

Advantages of slugging are usually based on faster handling for short pieces in the shop, fast cutoff, and short machine cycles. It usually takes place on automatic chuckers (AM—Sept 9 '57, p134). But AC Spark Plug finds that cold-extruded blanks for spark-plug shells can be handled on bar machines fitted with special handling devices for the short parts. The slugging system here saves material, and provides the advantages of cold-extruded steel. Using bar automatics instead of automatic chuckers is evidently no disadvantage, because the machines are rigged with vibratory feeders, selectors, automatic loaders, and auxiliary spindles.

FORMING

Notching Presses Automated

Magazine feeds enable one operator to handle several notching presses at General Electric's small ac motor department at Schenectady. Lamination blanks are placed in a bowl-type magazine, from which the bottom lamination is fed to the notching fixture. The feed is pneumatically operated.

The magazine feeder may be loaded while the press is in operation. Supplied by the Hudson Div., Emhart Mfg Co, the feeder does not interfere with flexibility. Only 1½ to 2 hr is required to make a new setup.

Rotor laminations are produced on V&O No. 410 notching presses having speed ranges from 250 to 750 strokes per min. Generally, stator laminations are punched on 225-ton mechanical presses.

Simplified Spring Looping

Secondary spring looping is eliminated by an automatic attachment developed by Sleeper & Hartley, Inc, Worcester, Mass, to fit a slightly modified version of their No. 0 spring coiler. Springs with as few as three coils can be looped at both ends in wire sizes from 0.010 to 0.020 in. Spring diameters from ⅛ to 3/16 in. have been tested so far, but final range is expected to be greater. Production is 50 springs/min. Tools are based on those for standard looping machines.

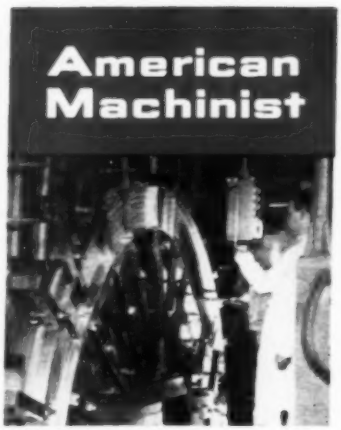
Giant Press Forms 500 Alloy

Until recently the jet-engine blade material, 500 alloy, has been forged in articles weighing up to 50 lb and measuring roughly 10 in. in dia. But Wyman-Gordon Co, Worcester, says that it has made a closed-die forging 45 in. in dia and weighing 520 lb. Forged thickness of the turbine wheel is only ¾ in.

The part was made on the 35,000-ton hydraulic press installed in the North Grafton plant. Ability to forge such large and thin sections in the high-temperature material opens possibilities for higher-performance jet engines.

CAUTION

These pages are not a synopsis of this issue of American Machinist. Major articles are described briefly in the Contents page. Because the Trends pages are classified by subject, they are not described anywhere else. Most of the developments in this department are so new that further information is not yet available—when it is, you will find a page reference to the article.



COVER:

Cost - cutting numerical control really pays off on aluminum bulkhead beams for Atlas missiles. H & B American Machine Co applies a 3-axis Kearney & Trecker profiling and milling machine to cut pockets to exact contours, saving 55% in machining time over conventional methods. Bendix tape control runs the machine, which works under subcontract to Convair-Ft Worth. *See page 94.*

HEAT TREATING

Production-Equipment Laboratory

Electric Furnace Co, Salem, Ohio, recently opened a new 14,000-sq-ft heat-treating laboratory for customer service and for its own process research. The lab is unique in that it is completely equipped with production equipment, including a protective-atmosphere continuous-strip furnace, a bell-type furnace, and a pusher-tray furnace.

No Miniaturization Here

While the emphasis seems to be on making all missile components smaller and smaller, the larger parts present a major problem for the heat treater. Rocket cases and other big

units call for special furnaces. Here is how some companies are meeting the problem:

- Solar Aircraft has a Lindberg controlled-atmosphere furnace that handles parts up to 9 x 30 ft at temperatures to 1950 F. It is electrically heated, and is reported to be the largest underground furnace of its type.
- Lindberg Steel Treating Co has an electric gantry-type controlled-atmosphere furnace that handles parts up to 7 x 24 ft at temperatures up to 2050 F.
- Commercial Steel Treating Corp has installed a Holcraft gantry-type controlled-atmosphere furnace capable of handling 6 x 28-ft parts up to 1850 F. This unit is heated by gas-fired radiant tubes.
- Norris Thermador Corp has a natural-gas-heated gantry-type furnace for parts up to 5 x 15 ft at temperatures up to 1850 F. It was built by Natural Gas Equipment, Inc.

INSPECTION

STUB Meter Modified

Stanford Research Institute's STUB meter—a sonic device that tests materials non-destructively—is now geared for production applications in a version much simplified from the original instrument. An inexperienced operator can be trained in five minutes to handle it now; the original required a man with some electronic training. The new model has a more limited sonic range, but the original unit had a wide range, not all of which was useful. Plans are being made to adapt the meter for multiple probes and automation.

TV Looks Inside Pipe

Closed-circuit television is being used in a wide variety of industrial and institutional applications ranging from microscopic inspection of minute parts on a production line to viewing the interior of huge furnaces.

A new application of close-circuit TV is internal inspection of boiler tubes which are 3 in. in diameter. Diamond Power Specialty Corp, Lancaster, Ohio, met this problem and solved it by designing a high-definition television camera with a maximum diameter of 2¾ in. for the Westinghouse Bettis Atomic plant in Clariton, Pa.

Westinghouse had come to Diamond with the problem of inspecting welds in tubes with an inner diameter of 3 in. Diamond's camera, including the necessary optical system and the internal lighting, is completely contained in a cylindrical structure only 30½ in. long. The camera is fastened rigidly to a square drive rod at the rear of the housing so it may be lowered in and out of the tubing and rotated through 360° for complete observation of the tube interior. A special portable stand to support the camera-control unit and monitor is also supplied.

THE OUTLOOK

Metalworking production, based on man hours worked, is almost at the peace-time peak, and is likely to set a new record before the year's end. A long steel strike would temporarily depress operations, but July output will hardly be affected at all by a strike.

WELDING

Progressive brazing

A new, travelling furnace progressively brazes long, narrow sections of honeycomb at a rate of one ft per min.

Developed by Solar Aircraft Co of San Diego, Calif, the furnace system is still another approach to the problems raised by extra-long parts, particularly parts for North American's B-70.

The company already has a pilot model in operation and is building a production unit that will handle panels 24 in. wide and almost any length.

In operation, a honeycomb sandwich assembly is laid up on permanent mandrel stations and then brazed without being moved. The open-ended electric furnace moves over the assembly at a pre-set speed that provides the specified brazing cycle. The atmosphere is controlled, and brazing temperature can be set as high as 2100 F.

Solar officials say the system shows promise for reducing the cost of honeycomb parts. Principal advantages are smaller, cheaper furnace installation and elimination of station movements in preparation and brazing steps.

ASSEMBLY

Automated Dip Soldering Unit

The first standing-wave-type integrated dip-soldering unit commercially available is being offered by Electrovert, Inc. It conveys the circuit boards, applies flux, removes solvents, preheats, and solders in an automatic cycle, taking boards up to 9½ in. wide. Boards 24 in. long are being soldered with the unit at present.

Solder is deposited by standing wave, created by an impellor. This allows straight-line production up to 15 fpm—and boards can be produced at 800/hr or more. Heat is controlled to remove flux solvent and preheat the boards, which prevents thermal shock when the boards pass over the wave of solder that joins components and wires.

Bond for Fluorocarbons

Materials such as Teflon or Kel-F can now be bonded to metal, rubber, and other plastics, such as epoxy, by treating them with a special solution called Fluorobond, produced by Joclin Mfg Co, Wallingford, Conn. Application can be by brush, spray, or dip, and it works in 15 sec. Bonding strengths are high, and electrical properties are not impaired. Material as thin as 0.0005 in. can be treated and bonded. Fluorocarbon plastics were previously not bondable.

FINISHING

Better Bumper Plate

Automotive industry is feverishly investigating improved plating techniques for its 1960 models. Salt air in the Gulf area and excessive salt on northern highways—especially around Detroit—took a heavy toll last winter, and some 1959 models are already showing severe rusting on bumpers.

GM is checking into a Udylite chrome-nickel-chrome process in which nickel is applied over a chrome base instead of the usual copper. Also under test at GM are a high-temperature chrome process and a periodic-reverse process developed by Westinghouse and Hanson-Van Winkle-Munning.

Ford is continuing its white brass finish, which has withstood the past winter better than any other treatment, but is also testing other processes.

One GM division is trying a modification of the white-brass technique. Whatever the outcome, it is going to cost a lot of money to make the changeover, and GM will have to spend millions to set up for the white-brass or chrome-nickel-chrome process. In the long run the customer will foot the bill, as always, but it

appears that buyers of 1960 models will at least get bumpers with some plate on them that won't peel or rust within the first six months.

MATERIALS HANDLING

Foot-Controlled Lift Trucks

Foot control of forward and reverse movement is now available on several models of the Hyster Company's lift trucks. The "Monotrol" control system incorporates forward-reverse selection and throttle control in a single pedal located where the foot throttle normally is.

Light foot pressure on the left side of the pedal produces forward movement; pressure on the right side reverses the truck. Sustained pressure accelerates the engine in the normal manner.

The system has an important advantage over conventional truck controls: It frees the operator's hands for steering and load control. To further simplify truck operation, there are pushbuttons, mounted on the dashboard, that control "park" and "drive" functions (setting and releasing the brakes, opening and closing the starter circuit).

MATERIALS & COMPONENTS

New Light Casting Alloys

Capacity for service at 500 F, and good mechanical properties up to 800 F, are claimed for a new magnesium alloy developed by Dow. The alloy can be die cast in conventional equipment with only minor changes in method. The alloy has 1% manganese, 1% thorium, 98% magnesium; and it will accept most standard finishes. Test bars are reported to exhibit tensile strengths of 30,200 psi at 70 F, 16,800 psi at 400 F, 12,400 psi at 600 F, and 7800 psi at 800 F. Density is 64 lb/cu ft.

An aluminum alloy obtained by varying the chemical composition of a conventional aluminum alloy is said to offer weight savings in sand- and permanent-mold castings. This is a high-purity, special-purpose material developed by Rolle Mfg Co, Lansdale, Pa. Missile casings in the alloy are reported to exceed the physical specifications of MIL-C-21180A. In T-6 condition, ultimate tensile strength can be controlled within 40,000 to 50,000 psi; yield within 30,000-40,000 psi; and elongation within 2-5%.

Welded Stainless Honeycomb

Lower cost is combined with "extraordinary resistance to handling damage" and greatly improved physical properties in a new welded honeycomb produced by Hexcel Products, Inc, Berkeley, Calif. It is called a "condition C" stainless honeycomb, and is said to have a core with a metallurgically superior weld plus superior surface finish—both of which contribute to easier brazing. Cell sizes are 3/16 and ¼ in. in gages of 0.001, 0.0015, and 0.002 in. Alloys available include PH 15-7Mo, 17-7Ph, and AM-350.

Freer-Machining Aluminum

Long spiral chips that build up between the tool and the work can be prevented by adding small quantities of lead and bismuth to a medium-strength heat-treatable aluminum alloy. This method, developed by ICI Metals Div in England, and known as Kynal 11S, evenly disperses particles of the two elements in the aluminum to act as internal chipbreakers. High cutting speeds can be applied, and tools do not need the usual generous top and side rakes—in fact, small rake angles similar to those for free-cutting brass are recommended. Small chips readily fall away from the cutting operation. Typical ultimate tensile strength of the alloy is 50,000 psi; elongation in 2 in. is 12%. Minimum values for tensile and elongation are 43,000 psi and 10%.

MANUFACTURING CONTROL

Back to Specials

In spite of the general current trend to apply universal, all-purpose machines whenever possible in a job shop, GE at its Large Steam Turbine plant is going the other way—to specialized single-purpose machines. The reason is that GE does not consider general-purpose machines productive enough. The plant handles small orders of large equipment—produced on large machine tools—so this reversal is somewhat significant. At the same time the single-purpose machines being installed are controlled more and more by programmed tapes, which puts numerical control to best advantage on runs with a small number of parts. See p87.

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CINCINNATI

You get DEPENDABLE PRODUCTIVITY

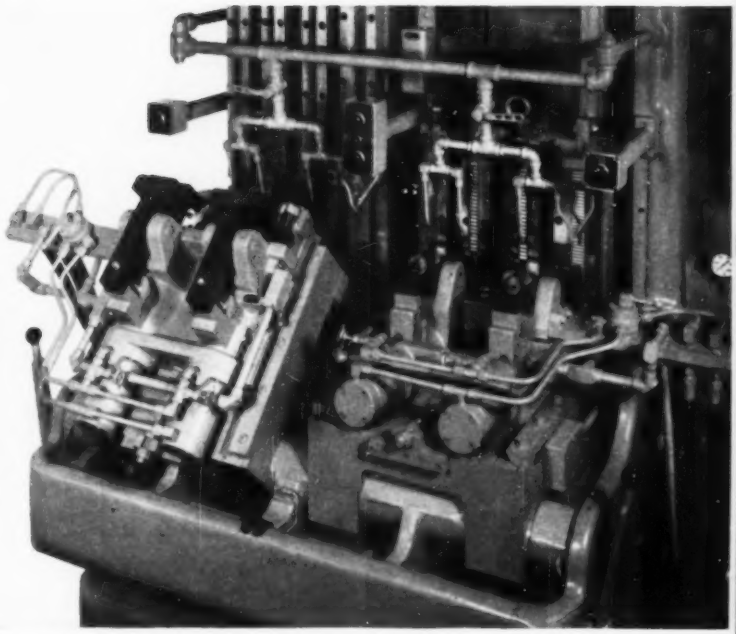
with SURFACE BROACHING EQUIPMENT

built by

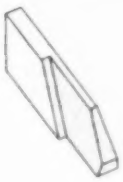
CINCINNATI | SPECIAL MACHINE DIVISION

Several times a day you unknowingly come upon evidence of the *dependable productivity* of CINCINNATI Hydro-Broach Machines. Tiny parts for movie cameras, cylinder blocks for automotive engines, and hundreds of parts in between are dependably broached at the lowest possible cost on various sizes and styles of CINCINNATI Hydro-Broach Machines. Components required to produce other parts also are broached on CINCINNATIS. Cutter blades are a typical example.

Dependable productivity is a prime requirement for high production equipment. And CINCINNATI Hydro-Broach Machines, with tooling by the Special Machine Division, are doubly dependable. The example at the right, and those on the next two pages, demonstrate their dynamic possibilities. May we give you a thorough analysis by one of our Surface Broaching Specialists? **Special Machine Division, The Cincinnati Milling Machine Co., Cincinnati 9, Ohio.**



Tilting tables on this CINCINNATI No. 10-54 Duplex Vertical Hydro-Broach facilitate work handling. Two hydraulic four-station fixtures, built by the Special Machine Division, accommodate six different right- and left-hand cutter blades. Drawing below shows typical part, broached surfaces shaded.



Part name . . . Blade
Material . . . . Mild steel
Operation . . . Broach carbide seats and clearance angles
Production . . 282 per hour at 80% operator efficiency
Machine . . . . . CINCINNATI No. 10-54 Duplex Vertical Hydro-Broach. Catalog No. M-1848-1

SPECIAL MACHINES • VERTICAL AND HORIZONTAL
BROACHING MACHINES • COMPLETE PRODUCTION LINES

CINCINNATI®
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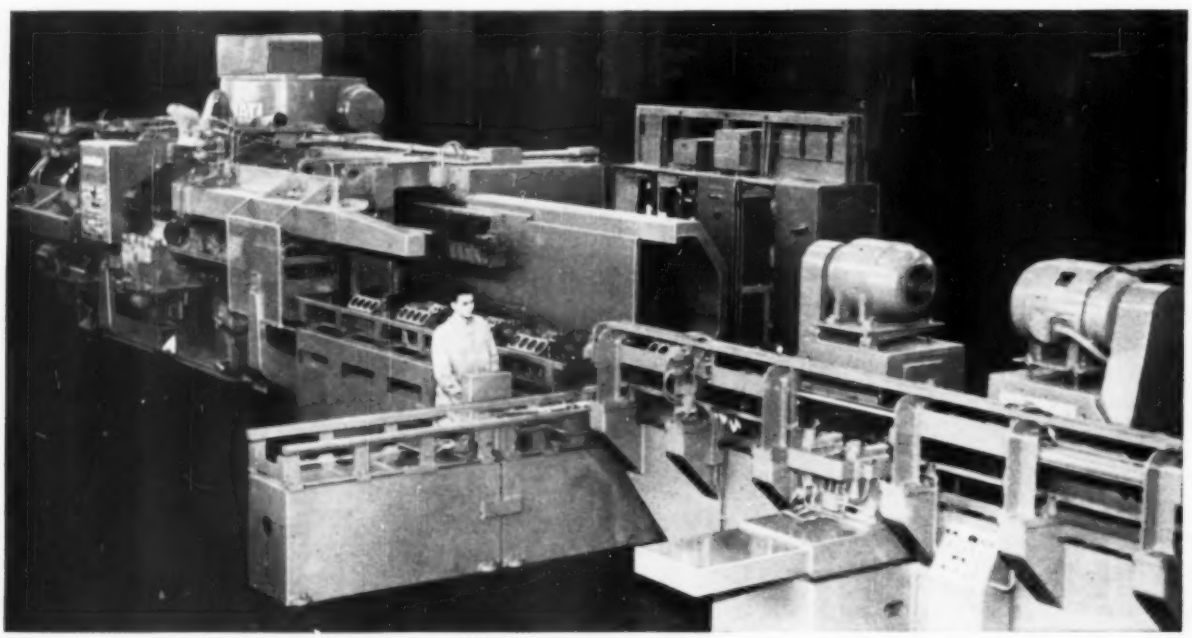
incorporates

in Cylinder Block Broaching



Broaching and milling of cylinder blocks are coordinated in this *dependable productivity* team of a CINCINNATI Horizontal Hydro-Broach and CINCINNATI Special Duplex Milling Machine.

CINCINNATI

The amazing records of the automotive industry are a tribute to the *dependable productivity* of CINCINNATI Horizontal Broaching Machines. Every major passenger car maker depends on these machines for cylinder blocks and heads. And many additional CINCINNATIs are broaching other parts such as exhaust manifolds, bearing caps, connecting rods, steering elements. The Special Machine Division quite often includes other Cincinnati machines in the *dependable productivity* plan, such as the Special Duplex Milling Machine teamed up with the Horizontal Broaching Machine (shown above). Broaching and milling proceed as a coordinated sequence of operations, at the rate of 100 blocks per hour.

DESIGNERS AND BUILDERS OF SPECIAL MACHINES • VERTICAL AND HORIZONTAL BROACHING

THE CINCINNATI MILLING MACHINE CO., CINCINNATI 9, OHIO

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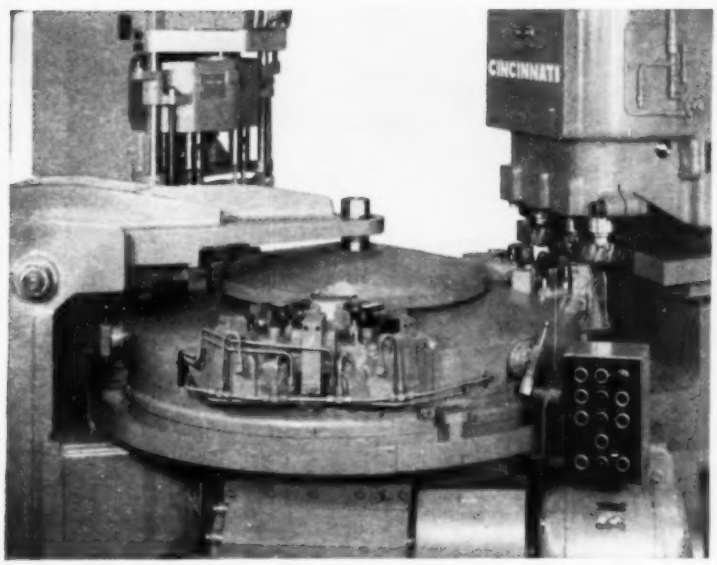
DEPENDABLE PRODUCTIVITY...

and Milling Line

and in Rotary Table Multiple Operation Machines



Three dissimilar operations on exhaust manifolds are combined in one automatic cycle on this CINCINNATI special multiple operation machine.

Part name ..... Exhaust manifold
Material ..... Cast iron
Operations ..... Mill joint face, drill 7 holes, broach joint face
Production ..... 112 per hour, at 80% operator efficiency

Production machines of this type have much in their favor: compactness; adaptability to changes in shop layout; push-button control; automatic cycling. The Cincinnati Special Machine Division incorporated all these advantages, plus a high degree of *dependable productivity,* in the multiple operation Rotary Table Machine at the left. It mills, drills and broaches exhaust manifolds in one automatic cycle.

A wide range of companies in many industries throughout the country have improved their operating performance and the quality of their products through the assistance of the Cincinnati Special Machine Division. Perhaps you too can find a solution to *your* cost-of-production problems, through our Engineering Service Specialists and our facilities for building cost-reducing equipment of any size.

MACHINES • COMPLETELY AUTOMATED PRODUCTION LINES

CINCINNATI®
SPECIAL MACHINE DIVISION

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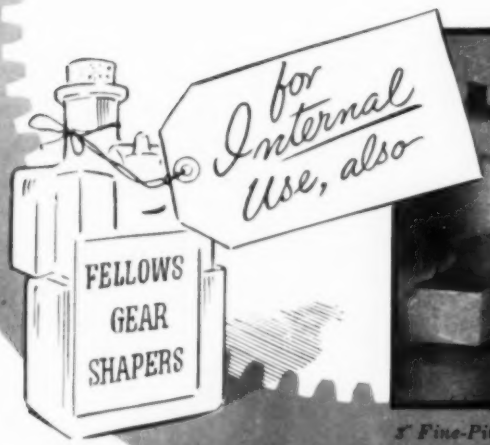
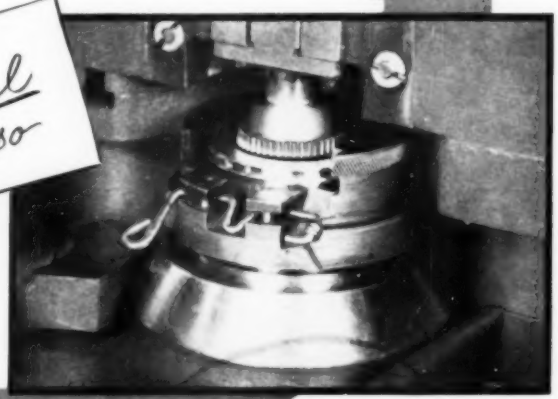
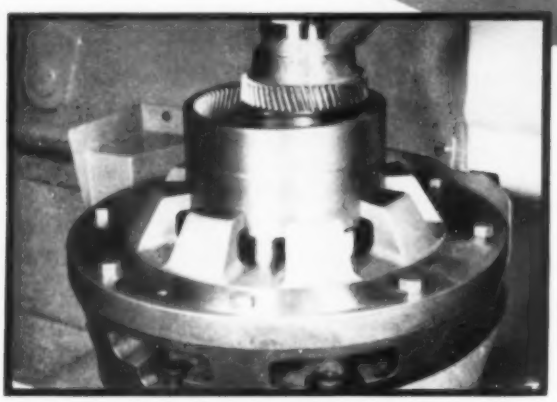
FELLOWS GEAR SHAPERS cut INTERNAL Gears

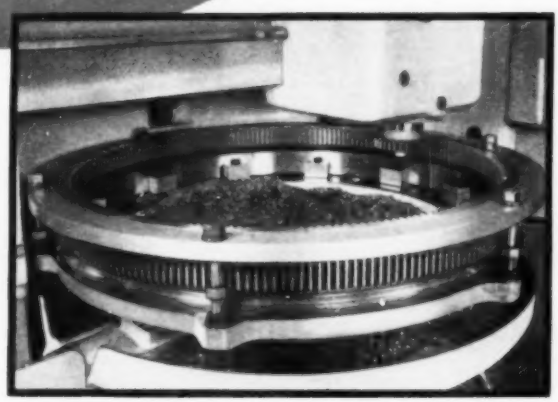




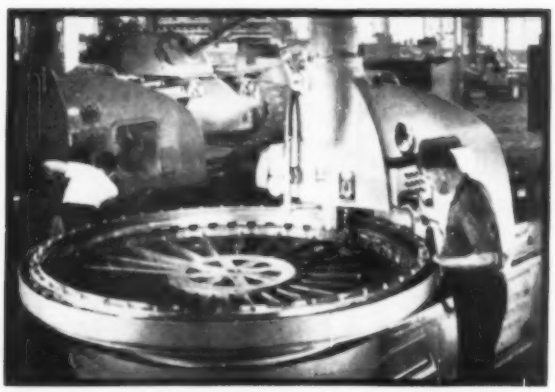
5" Fine-Pitch Gear Shaper cutting internal gear



No. 10 Rotary Gear Shaper cutting internal helical.



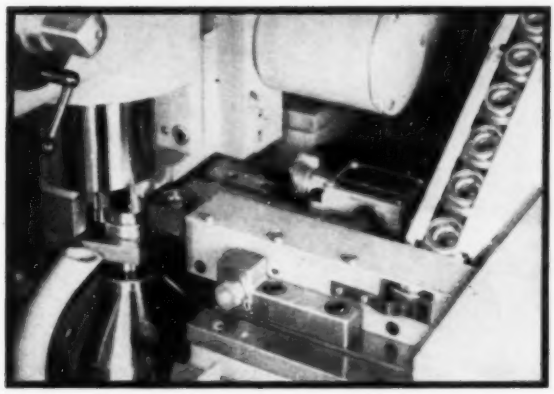
36-Type Gear Shaper with special work-holding fixture.



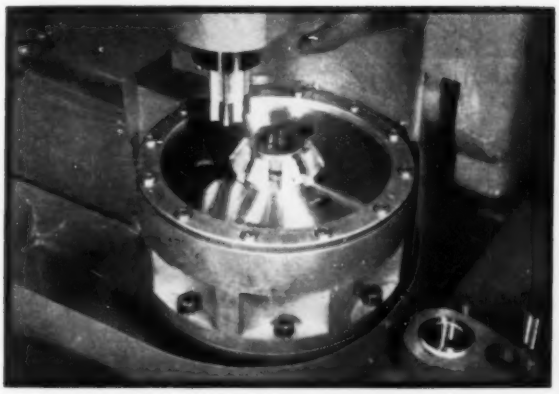
120" Gear Shaper cutting light tank turret gear.

THE PRECISION LINE

as EASILY as Externals



4GS Gear Shaper with full-automatic operation.



7A-Type Gear Shaper with fast-action diaphragm chuck.

Not only internal gears, but splines, clutches and an almost unlimited variety of other internal shapes can be produced on versatile Fellows Gear Shapers just as simply, rapidly and economically as external shapes. In many cases, the same Gear Shaper cutter can be used to cut both internal gears and their mating pinions.

Set-ups and change-overs are simple and fast on any Gear Shaper from the 3-Inch Fine-Pitch to the 120-Inch. Rigid construction makes it possible to hold close tolerances at high production rates. On some models, full or semi-automatic operation is available whenever the size and shape of the work and the production requirements make it practical.

Your Fellows Representative can give you full information about the production benefits of Fellows gear shapers, shaving machines, grinding machines, inspection instruments, or cutting tools. Just contact the nearest Fellows office.

THE FELLOWS GEAR SHAPER COMPANY
78 River Street, Springfield, Vermont
Branch Offices: 1048 North Woodward Ave., Royal Oak, Mich.
150 West Pleasant Ave., Maywood, N. J.
5835 West North Avenue, Chicago 39
6214 West Manchester Ave., Los Angeles 45

Fellows *Gear Production Equipment*

....threading stainless steel on bar automatic

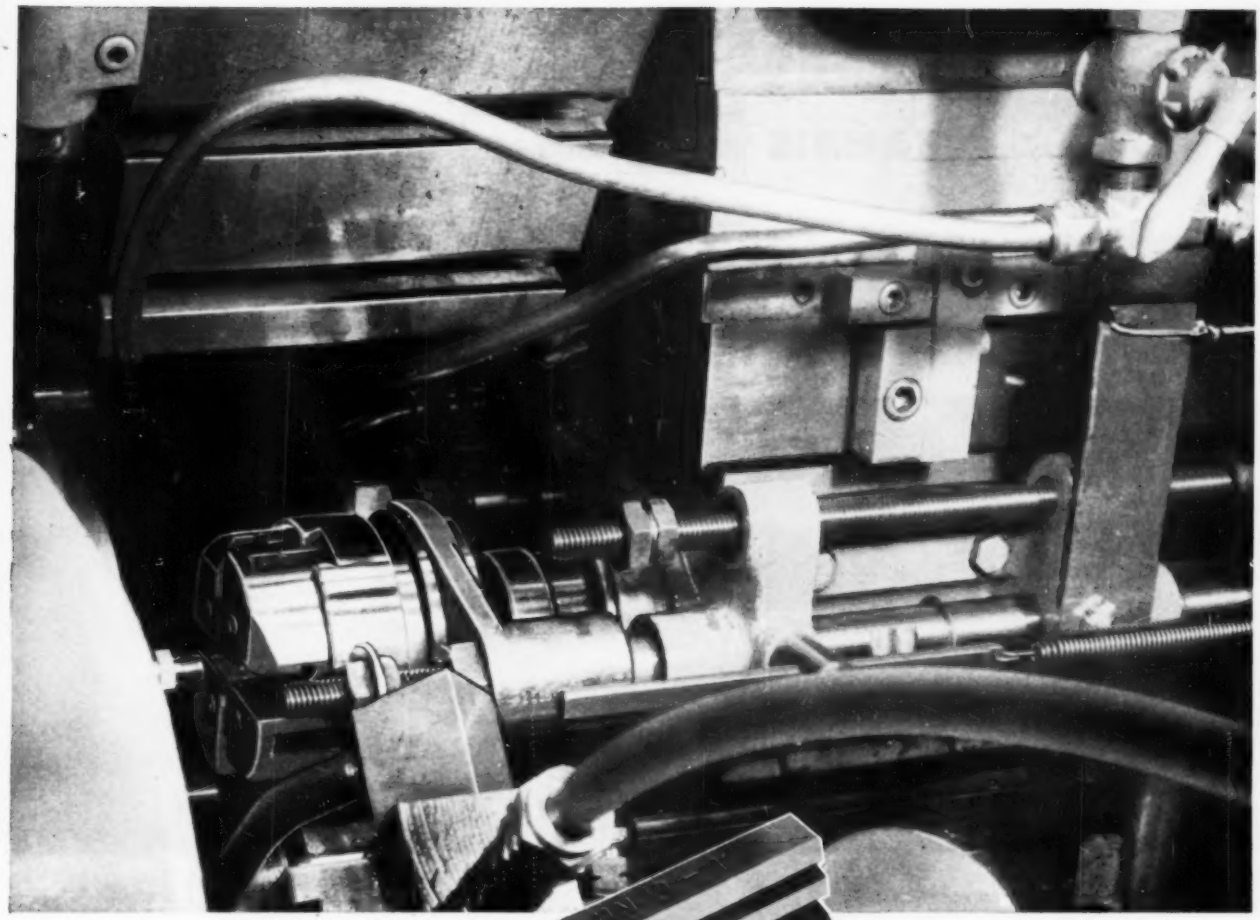
A LANDEX Hardened and Ground Die Head has maintained exceptional chaser life threading male connector tube fittings at the Crawford Fitting Co., exclusive user of LANDIS Equipment in Cleveland, Ohio.

7/16" 20 pitch UNF threads were cut to Class 3 fit from 316 stainless steel by a 7LLL Head mounted on a six-spindle Warner & Swasey Bar Automatic. 144 pieces per hour were threaded 5/16" long within 3/32" of a shoulder at 19 to 20 SFM. 4500 pieces were produced between chaser grinds using 30° short throat chasers.

This outstanding tool life is the result of basic chaser design and over 50 years of LANDIS research and experience in manufacture and hardening. For example, to ensure satisfactory die life, chasers are given special hardening when workpiece design or material specifications so indicate.

Long life between grinds, as illustrated here at the Crawford Fitting Co., is one reason why the use of LANDIS Tangential Chasers ensures threading economy. It is further important to know that these chasers, requiring only a few thousandths metal removal to restore the cutting edge, are usable for 80% of their original length. In addition, it is not necessary to remove the same amount of metal from all chasers of a set, or to replace the entire set at the same time.

LANDEX Hardened and Ground Heads are unmatched for precision threading and true economy on bar automatics and other live-spindle machines with limited clearance. Let us show you how to improve threading operations—send specifications and ask for Bulletin F-80.



The world's largest manufacturer of threading equipment

CUTTING • GRINDING

ROLLING • TAPPING

LANDIS *Machine* COMPANY

502C WAYNESBORO • PENNSYLVANIA • U.S.A.

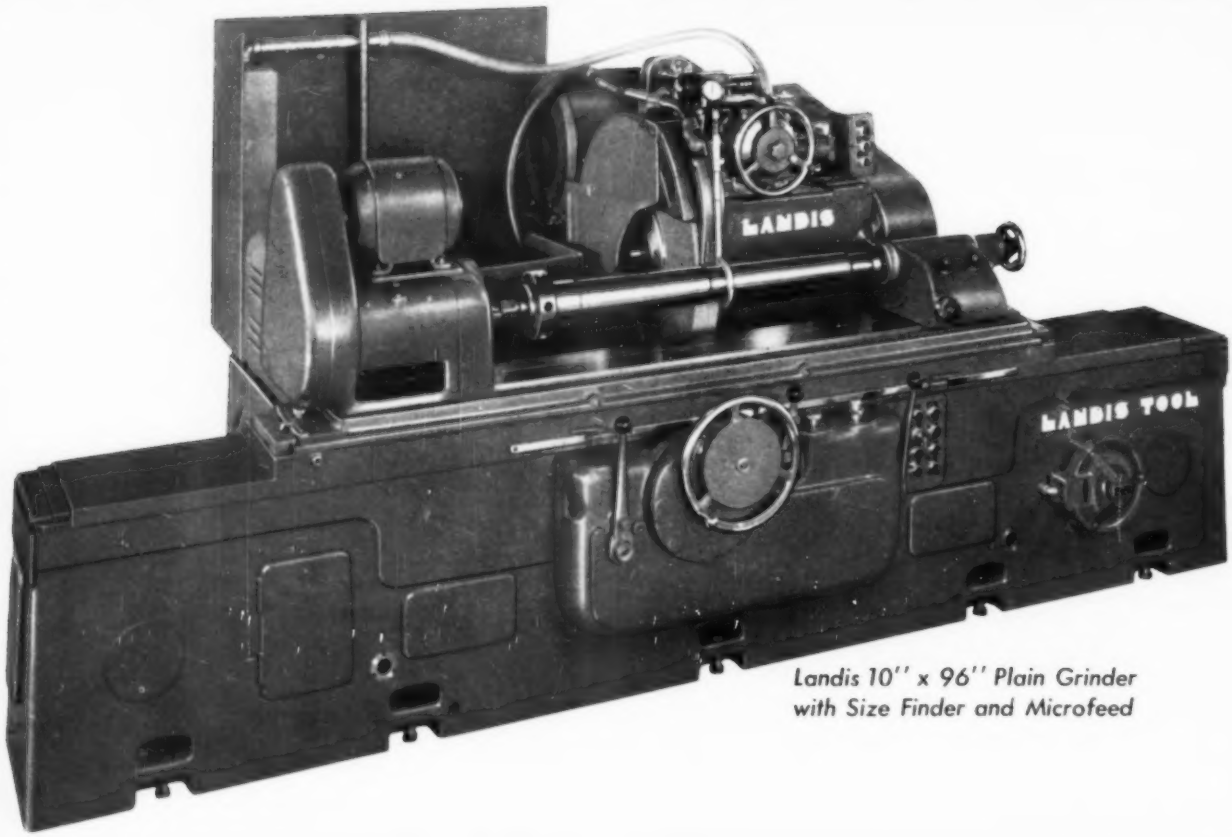
New idea cuts cost

LANDIS size finder with MICROFEED

Positive direct reading size finder cuts setup time

Landis MICROFEED assures "tenths" tolerances consistently

Eliminates costly rejects

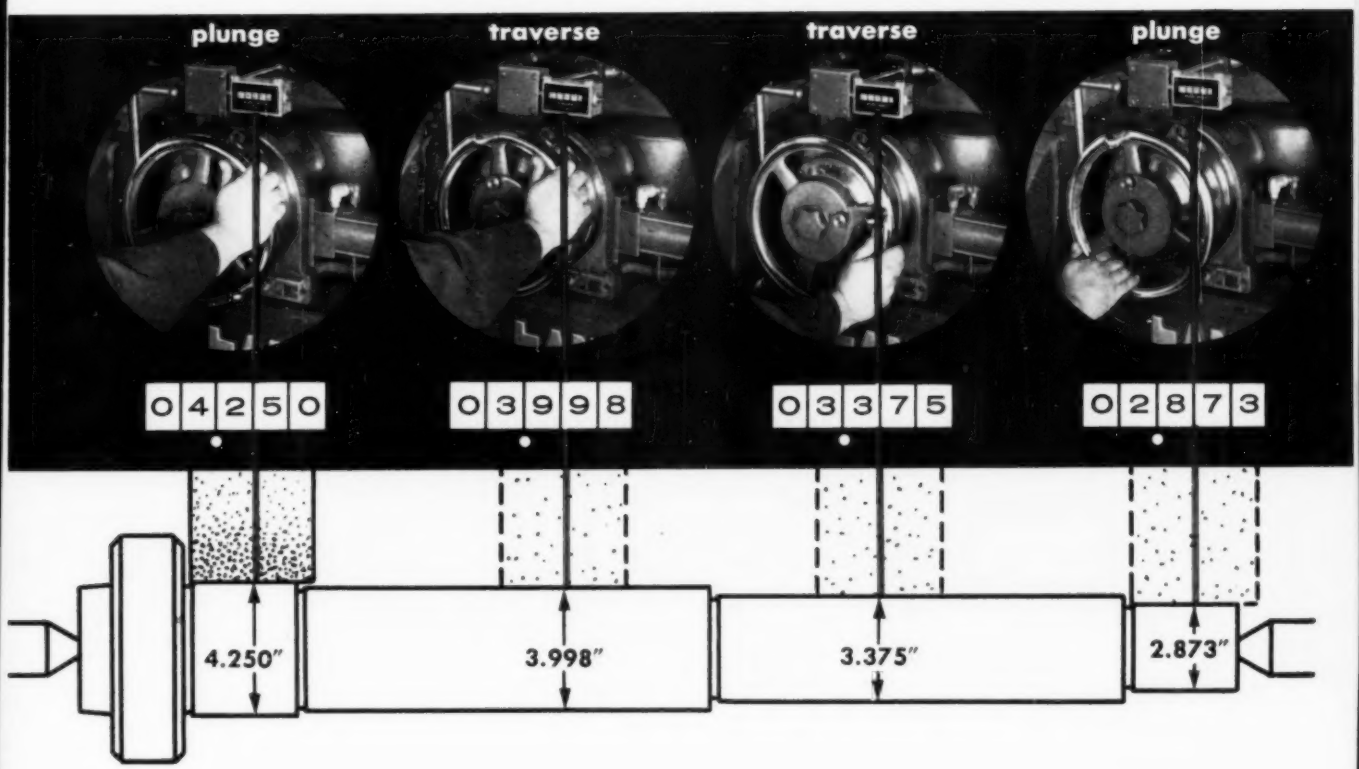


Landis 10" x 96" Plain Grinder with Size Finder and Microfeed

# of grinding shafts

shows remarkable savings on small lots

finish sizes set on direct reading dial



how size finder works

The operation of the machine is simple, even for unskilled operators. It's only necessary to set the finish dimension on the indicator by turning the wheel feed handwheel. Operator starts the cycle, applies the sizing gauge and stops the cycle when the gauge shows finish size. He moves the work table, resets the Size Finder for the next diameter and repeats the cycle.

You can make large savings on your small lot multiple diameter shaft grinding operations. Send us prints of your shafts for our proposal.

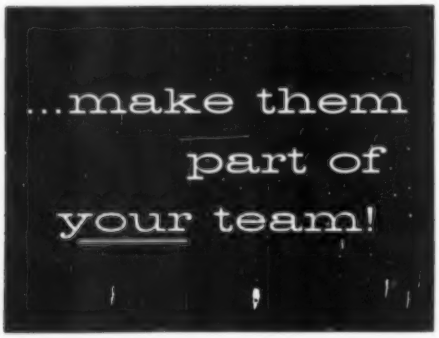
LANDIS

precision grinders

LANDIS TOOL COMPANY / WAYNESBORO, PENNSYLVANIA

MORSE
"TOOLMASTER"

The MORSE Team is the TOP T in the Cutting Tool

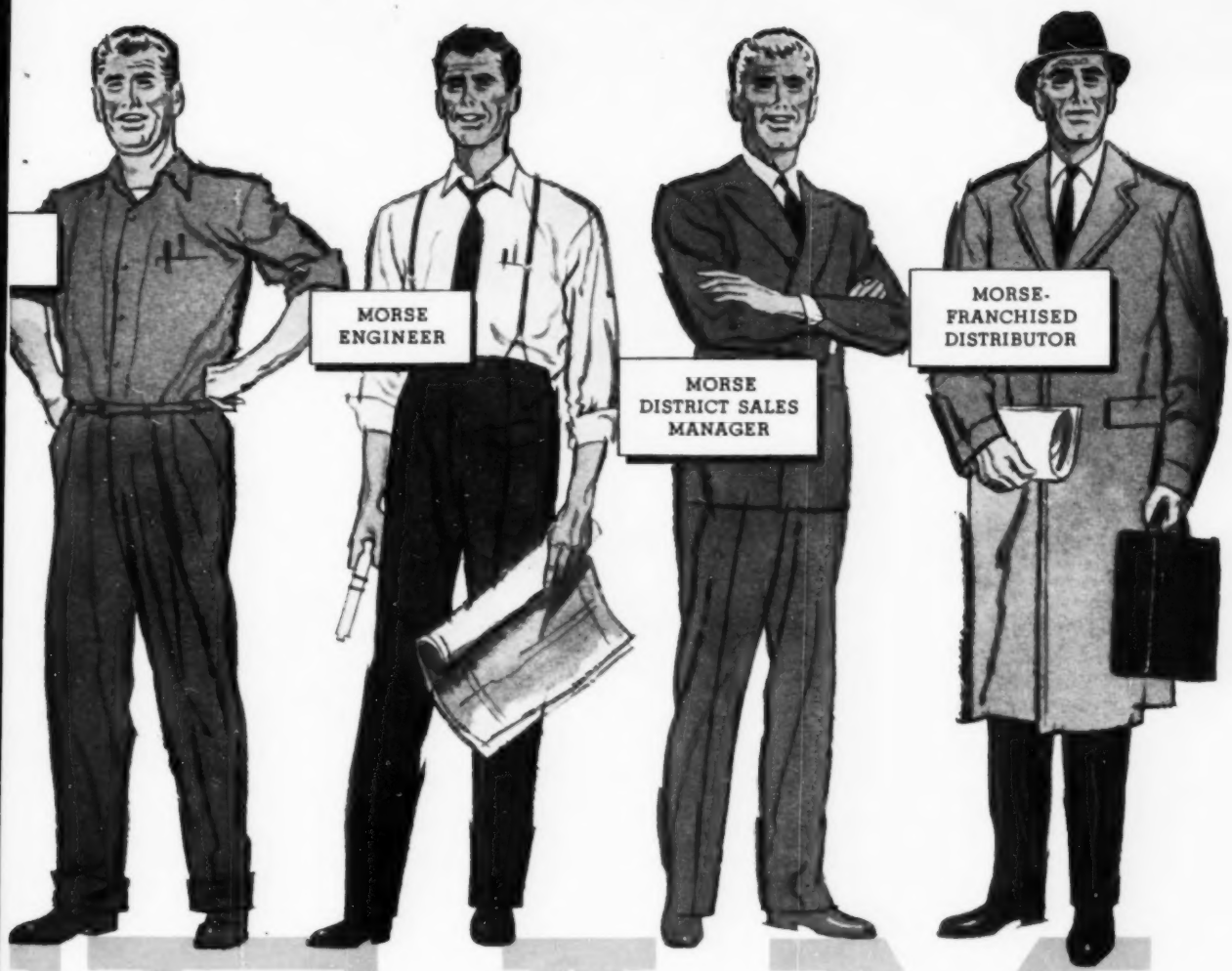


Here are the four hardest-hitting "linebackers" in the cutting tool industry . . . good people to have on *your* side.

From them you get *the most* in design, quality, service, and know-how in fitting the product to the job.

Yes, if you want *the most* for your cutting-tool dollar, mark that order MORSE.

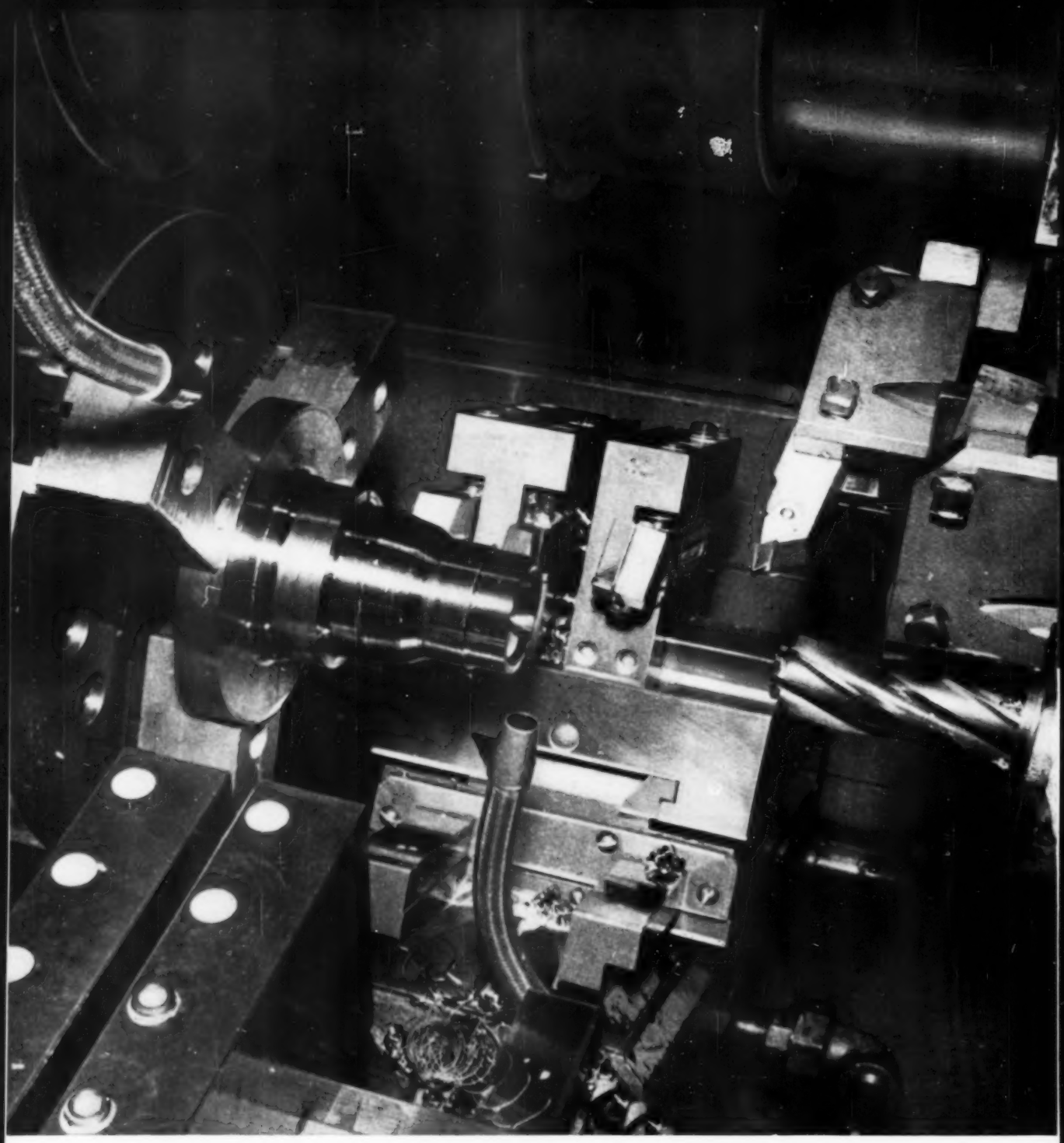
And call your Morse-Franchised Distributor *today*.



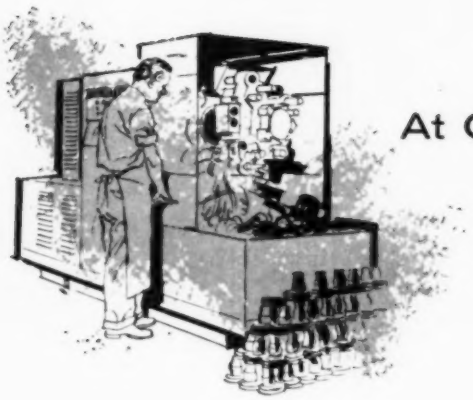
TEAM Industry

MORSE TWIST DRILL & MACHINE COMPANY
New Bedford, Massachusetts
A Division of VAN NORMAN INDUSTRIES, INC.
Warehouses in New York, Chicago, Detroit, Dallas, San Francisco

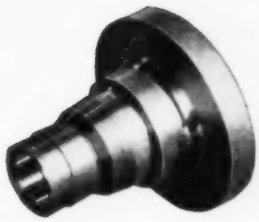
MORSE means "THE MOST" in Cutting Tools



Tooling stations with room to work permit time-saving multiple cuts to be set up easily, quickly on Warner & Swasey ACs. In this close-up photo of three stations on the first chucking of the 325-Stainless Steel nozzle, eight cutters are shown—three on the rear cross slide, two on the front cross slide and three in the turret station. The entire setup employs 16 cutters in seven stations. The skill and know-how of Crosby's own organization has handled the complete tooling of well over 100 similar parts—a tribute to the ease of tooling ACs to produce complicated parts in tough materials to close tolerances and fine finishes.



At Crosby Valve & Gage Company
WRENTHAM, MASS.



Production of Nozzles from 325-Stainless Forgings Nearly Tripled on Warner & Swasey "2ACs"

Further substantial cost savings are realized, too, because one operator easily tends the two Single Spindle Chucking Automatics — averaging as much production as six older hand turret lathes.

Machining tough materials is routine for this long-established Wrentham, Massachusetts, producer of quality safety and relief valves for the steam, petroleum, chemical and food industries.

For example, three pounds of metal are removed from these tough 325-Stainless Steel forgings during the first or roughing operation. Finish operations in the second chucking include a 14 and 16-pitch "V" form thread — tolerances of .002" — a 32 micro-inch finish — and two diameters, two faces and a bore that must be free of tool withdrawal marks. Output increased from 6½ to 17 pieces each 8-hour shift — a boost of 162%!

Compared to previously-used single spindle automatic chuckers, Crosby's new Warner & Swasey 2ACs are averaging up to 100% more production with 25% less time required to set up.

Crosby reports they especially like their 2ACs:

- **EASE OF TOOLING**—cross slide versatility, freedom from tooling interferences, ease of relieving turning, boring and facing cuts.
- **POSITIVE MECHANICAL THREAD LEAD CONTROL** for fine pitch threading accuracy in tough materials.
- **TWO-SPEED MOTOR** that gives greater choice of speeds, permitting efficient low speed threading as well as high speeds for finishing cuts.
- **RIGIDITY AND ACCURACY OF OVERHEAD TURRET DESIGN**—holding close tolerances and fine finishes no longer a problem.
- **CROSS SLIDE RIGIDITY AND SMOOTHNESS OF OPERATION**—cutter life on form cuts increased 2 to 1 over their other single spindle automatics.

WARNER & SWASEY
Cleveland
PRECISION MACHINERY SINCE 1880

You Can Produce It Better, Faster, for Less...
with a Warner & Swasey

The Ingersoll Milling Machine Company

Special Machine Tools

Rockford, Illinois

EDSON I. GAYLORD
GENERAL MANAGER

December 15, 1958

Mr. Everett Hicks
Vice Pres. and General Mgr.
Grinding Machine Division
Norton Company
Worcester 6, Mass.

Dear Everett:

We have just run one of the spindle and drive bar sleeves on our new Norton 18 x 96" Type LC-2 Plain Cylindrical Grinding Machine and I thought you would be interested in the results.

You estimated that this machine would do all the grinding and handling, except loading and unloading, in 350 minutes. Our actual grinding and handling time was 352.4 minutes.

This indicates that your estimates are thoroughly dependable and we look forward to beating them as we become better acquainted with the machine's operation.

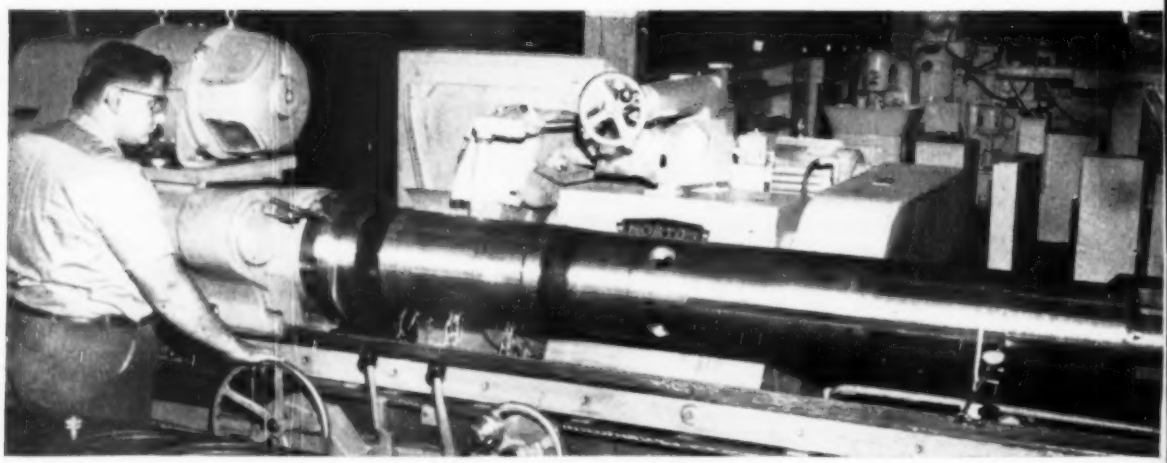
The last time we checked the performance of our Norton 10 x 48" Semi-Automatic Cylindrical Grinding Machine it showed a 46% time saving, compared with your estimate of 39%.

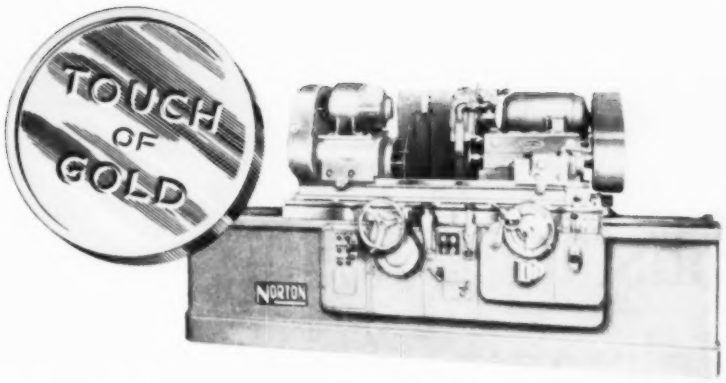
Time estimates like these are a great help. In fact, they are necessary to us, in implementing our equipment replacement policy.

Sincerely,

EDSON

Ingersoll reports how Norton Cylindrical Grinders save





as predicted

As Mr. Gaylord, the Ingersoll Milling Machine Company's General Manager, points out, Norton machines will give you increased production.

This increased production is just one of the proved "Touch of Gold" advantages of Norton grinding machines. Others are precise sizing control, low maintenance and long, continuous service life. These are designed into each machine.

Norton Cylindrical Grinders have swing capacities ranging from 4″ to 24″ and work lengths from 18″ to 168″. All are available as Plain Machines or Semiautomatics. All have controls for feeds and speeds grouped at the operating position, with key maintenance points located outside. And all are engineered for adaptability to meet changing production requirements, and for durability to keep on delivering economy under the toughest conditions of use.

Call in your Norton Sales Engineer, a well trained, long experienced specialist in grinding. He'll gladly give you an accurate estimate of what Norton grinding machines can do for you. NORTON COMPANY, Machine Division, Worcester 6, Mass. District Offices: Worcester, Hartford, Cleveland, Chicago, Detroit. In Canada: J. H. Ryder Machinery Co., Ltd., Toronto 5.

Photos show the types of cylindrical grinders used and described by the Ingersoll Company. Photo at upper right is a Norton 10″ x 48″ Type CTU; photo at left was taken in the Ingersoll plant, and shows their Norton 18″ x 96″ Type LC-2.

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GRINDERS and LAPPERS

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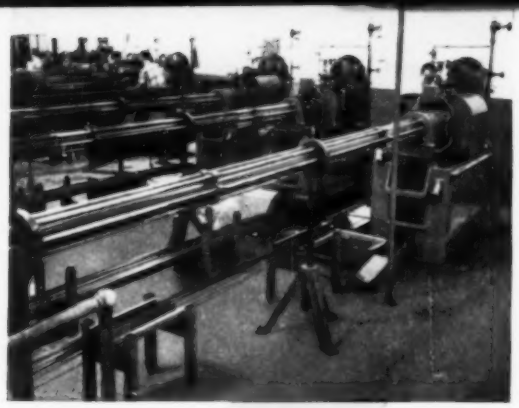
...to make your products better

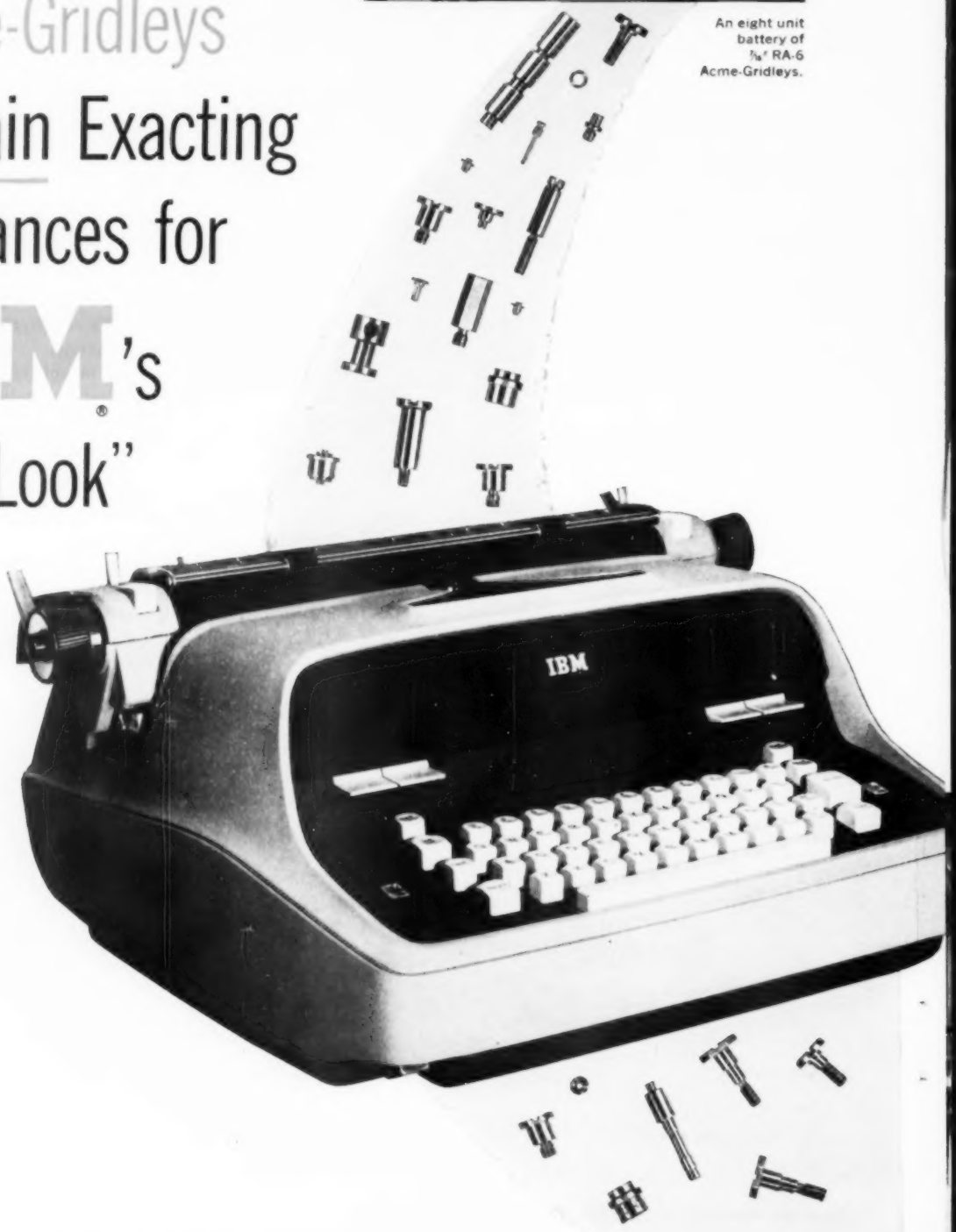
NORTON PRODUCTS Abrasives • Grinding Wheels • Grinding Machines • Refractories • Electrochemicals — BEHR MANNING DIVISION Coated Abrasives • Sharpening Stones • Pressure-Sensitive Tapes

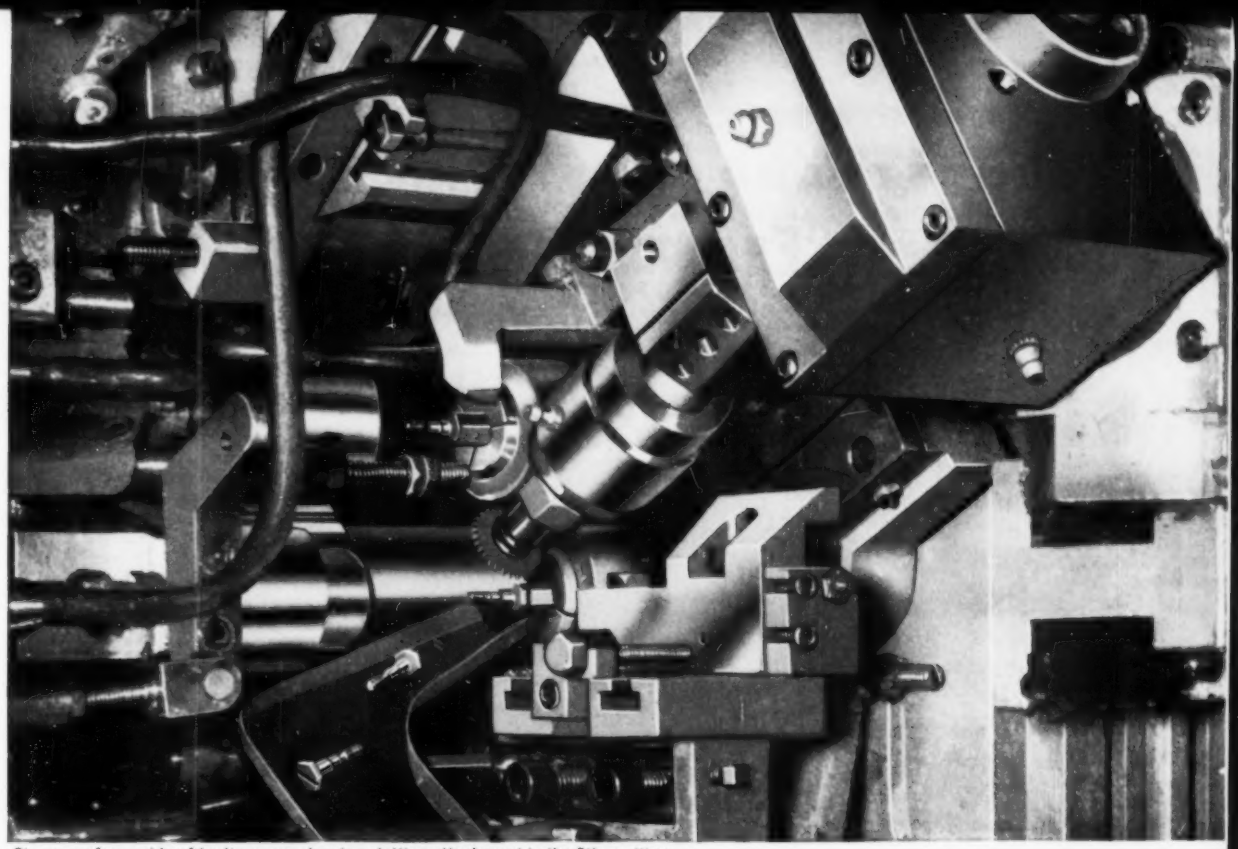
First Precision Component
in the Run . . . or Last



An eight unit battery of 7/16" RA-6 Acme-Gridleys.

Acme-Gridleys Sustain Exacting Tolerances for IBM®'s "New Look"



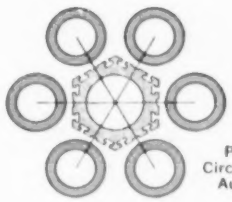


Close-up of rear side of tooling zone showing slotting attachment in the 5th position.

At IBM's modern Lexington, Kentucky plant, twenty Acme-Gridley 7/16" six spindle automatics are mass-producing the small to miniature parts for their sleek new electric typewriter. They help to provide IBM with greater *sustained* accuracy at lower cost than other comparable machines.

The precision components are held to closely controlled tolerances of .0005 t.i.r. These limits apply to the last piece in the run as well as the first, and consistent accuracy is maintained with less machine adjustment than ever before realized. Sustaining the closely controlled tolerances of these parts completely minimizes costly rejections during exhaustive quality control checks of the completed units. Inspection time is greatly reduced.

IBM has also found that the wide-open tooling zone of their 7/16" Acme-Gridleys permits much greater latitude in tooling up for complicated operations performed in a single set-up. This, plus the lasting accuracy of direct camming and the flexibility of independently operated toolslides, makes this newest member of the Acme-Gridley family a profitable asset to IBM's modern production line. Write for Bulletin



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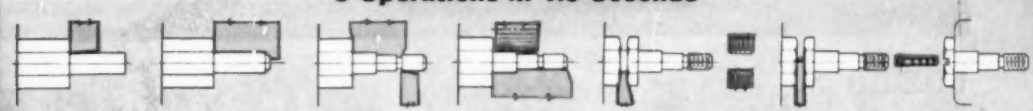
National Acme

The National Acme Company
171 E. 131st Street
Cleveland 8, Ohio

Sales Offices: Newark 2, N.J.; Chicago 6, Ill.; Detroit 27, Mich.

9 Operations in 4.9 Seconds

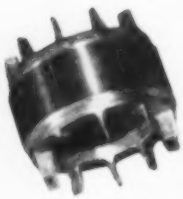


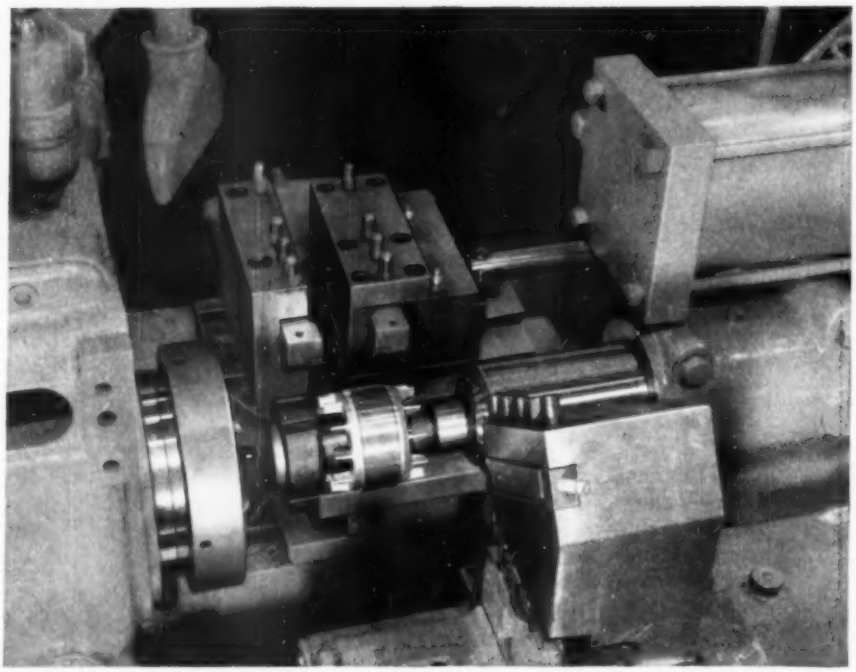
6. Rough Turn Front End
1. Rough Form and Chamfer Front End
2. Finish Form Two Diameters Finish Turn Thread Diameter
3. Shave Three Diameters
4. Breakdown for Cutoff-Thread
5. Cutoff-Pickup and Slot

SUNDSTRAND

"ENGINEERED PRODUCTION" NEWS

Stators of varied lengths turned on self-compensating lathe





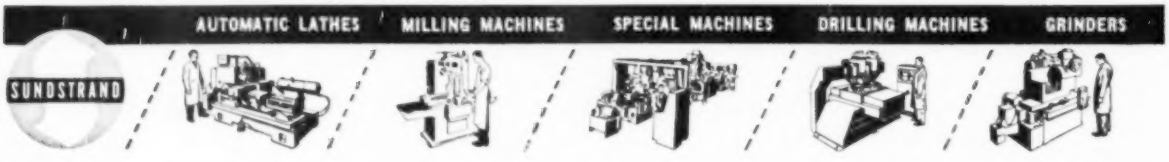
Finished stator at top shows turning and chamfering operations performed on machine equipped with power tailstock that automatically compensates for length of part. Rough and finish tools in front holder and chamfering tools in rear holder permit doing the job in a single cycle.

Single cycle turning — including rough and finish turning of the OD and chamfering of both ends of the stator — is handled on this Sundstrand lathe provided with automatic compensation for varied part lengths. The stator cores vary in length from $4\frac{1}{4}$ to 3 inches and production ranges from 115 to 154 per hour.

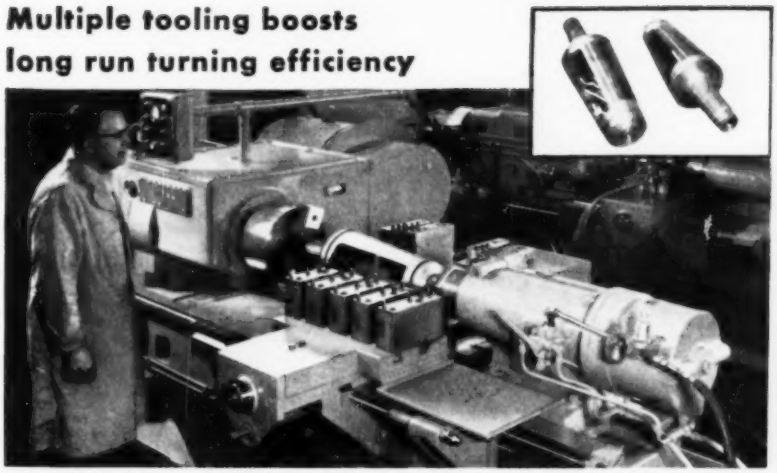
This job is a good example of how a modern machine of standard design — the Sundstrand Model 8 in this instance — can be adapted to the requirements of a specific job through the application of Sundstrand "Engineered Production." Even though the basic machine is standard, thus holding down capital investment, special tooling and a special powered tailstock automatically position the front and rear tools for the length of part being machined. This provides "custom" features for maximum production at minimum cost.

Sundstrand lathes are basically designed to use standard components to the greatest possible extent. Then, after the job requirements are studied by Sundstrand machine designers, tooling and manufacturing engineers, recommendations are made. Even when production requirements or configuration of the part is such that a "special machine" is needed, basically standard components still constitute a large part of the total machine.

Because Sundstrand designs, builds, and is experienced in the operation of every type of turning equipment, this combination of factors helps assure ultimate customer satisfaction both in price and performance.

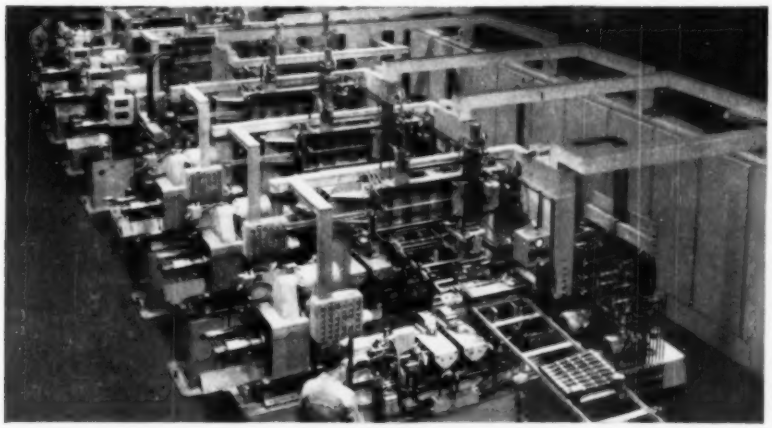


Multiple tooling boosts long run turning efficiency



Long runs requiring the machining of several surfaces on a single part provide an outstanding opportunity for cost reduction by combining operations through efficient tooling. This job being produced on a Sundstrand Model 12A lathe uses 5 front tools to turn the OD and 4 rear tools for grooving and chamfering various valve plugs.

Production ranges from 9 to 35 parts per hour depending on the size of the valve component. Part shown in the inset is one of the larger sizes being produced, measuring 9¼ in. diameter and 18 in. long. Fast setting of machine cycle control and accessibility of tooling make changeover for other sizes a quick and simple operation, holding down-time to a minimum.

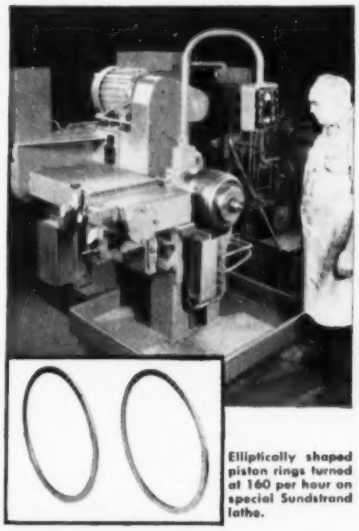


Special automatic loading process lathe by Sundstrand produces over 200 camshafts per hour at 80% efficiency, yet carries out the basic Sundstrand idea of maximum utilization of standard components. Obviously, the automatic handling equipment plus the automatic transfer, loading, and unloading of workpieces makes this a custom designed installation; yet a Sundstrand "Engineered Production" analysis prior to start of actual design determined that a number of standard components were ideally suited to the operations required.

Eight lathes in two lines use carbide tools for roughing and cemented oxide tools for finish turning. Because workpieces are supported as close as possible to surfaces being machined, exceptionally fine surface finishes are produced.

Eliptical shapes produced on special machine

When it comes to special turning jobs — those that can't be handled by conventional machines due to their configuration or any other reason — Sundstrand designs and builds special machines to meet these requirements.



Elliptically shaped piston rings turned at 160 per hour on special Sundstrand lathe.

This lathe for elliptical turning of the OD of piston rings provides a good example of how Sundstrand handles the special jobs economically. A special eccentric front slide, cam actuated with a power take off from the rear of spindle, is used for elliptical turning of piston rings ranging in size from 8 to 21½ inches. Production rate averages 160 rings per hour.

Sundstrand has designed and built numerous specially designed lathes for every conceivable type of turning job. The experience gained in solving these problems is your assurance of getting top results on your job.

For more data on how Sundstrand "Engineered Production" is applied to small lot, long run, and special turning jobs, write for Bulletin 104 today.

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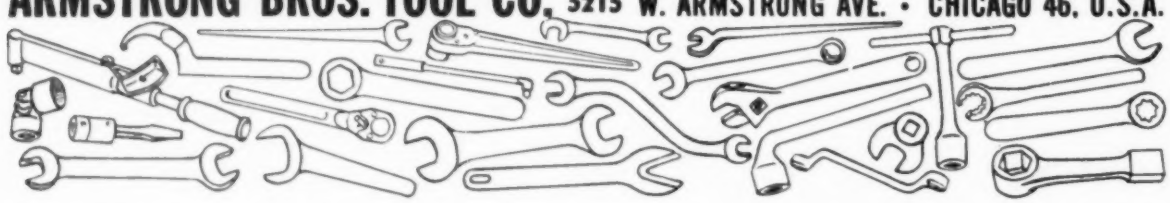
If you don't know your local ARMSTRONG Distributor, we will send you the names of those in your area.

An ARMSTRONG Wrench feels right—is balanced. It goes over nuts or screw heads easily, grips firmly without sloppiness, won't round corners—because openings are carefully machined to correct sizes. It's safe, strong beyond need without clumsy bulk—because of superior design and selected steels, heat treated to proper degree of hardness and tensile strength. It's quality finished, ARMALOY (alloy steel) Wrenches in chrome plate with heads buffed; HI-TEN (carbon steel) Wrenches in baked-on gray enamel with heads ground bright . . . all plainly marked for size. All are uniformly excellent tools manufactured under strict quality control, by modern methods, with modern equipment in a modern tool plant . . . 1537 different industrial sizes and types—single wrenches, or sets in metal cases, boxes or rolls . . . each a quality tool. Armstrong Wrenches are "Fine tools that encourage good work."

ARMSTRONG BROS. TOOL CO. 5215 W. ARMSTRONG AVE. • CHICAGO 46, U.S.A.



Your best buy in small surface grinders

built to Landis precision grinder standards

- low first cost
- dependable accuracy
- unit construction for easy inspection and maintenance
- big machine capacity

  12" capacity under a 12" wheel

  a full 150 square inches of surface area

  grind deep with accuracy—3½" under head to bottom of wheel

Send for new catalog of Landis Abrasive Surface Grinders

ABRASIVE
precision surface grinders

a product of
LANDIS TOOL
world's largest manufacturer of precision grinding machinery
WAYNESBORO, PENNSYLVANIA

You get real "blue chip" performance from these tools built by LAPOINTE

BROACHING Machines, and the other tools built by Lapointe, function with a degree of accuracy that is unequalled elsewhere. That's understandable, since they are created from an engineering background represented by nearly 60 years of uninterrupted experience — all of it in the field of broaching.

If you're looking for performance, Lapointe machines will give it to you, day in and day out, year after year. And if you're looking for dependability and reliability in the company itself, Lapointe has *that,* too! Lapointe has become known as "Broaching Headquarters" by the large — and small — production plants throughout America. In changing times like these, what counts the most is *character.* It's an old-fashioned virtue which gives the purchaser of a machine a comfortable feeling of confidence.

THE LAPOINTE MACHINE TOOL COMPANY

HUDSON, MASSACHUSETTS • U.S.A. *In England: Watford, Hertfordshire*

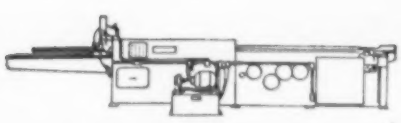
THE WORLD'S OLDEST AND LARGEST MANUFACTURERS OF BROACHING MACHINES AND BROACHES

LAPOINTE BROACHING MACHINE

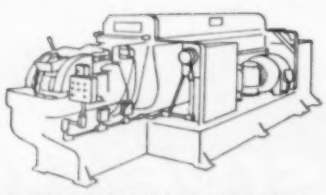
Designed with a precision-indexing fixture to broach "pine tree" forms on costly wheel-and-shaft integral forgings for gas turbines, this machine broaches 45 intricate slots per hour . . . **without any rejects.**

If you are machining repetitive forms by milling, shaping, planing, grinding or some other conventional method, it will be to your advantage to investigate the time-saving and cost-reducing results obtainable by converting to Lapointe-Broaching.

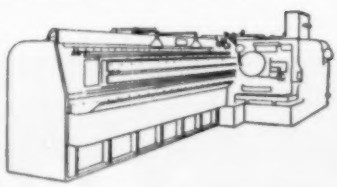
Lapointe-built Broaching Machines are available in hydraulic and electro-mechanical drives.



60" STROKE HORIZONTAL, ELECTRIC



CH CONTINUOUS BROACHING, ELECTRIC



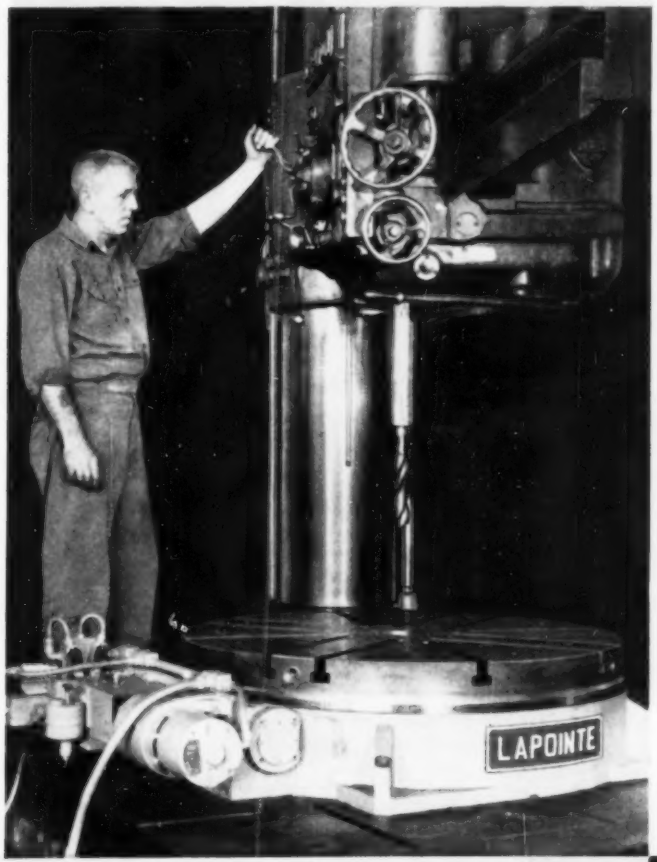
SRHE SINGLE RAM HORIZONTAL, ELECTRIC

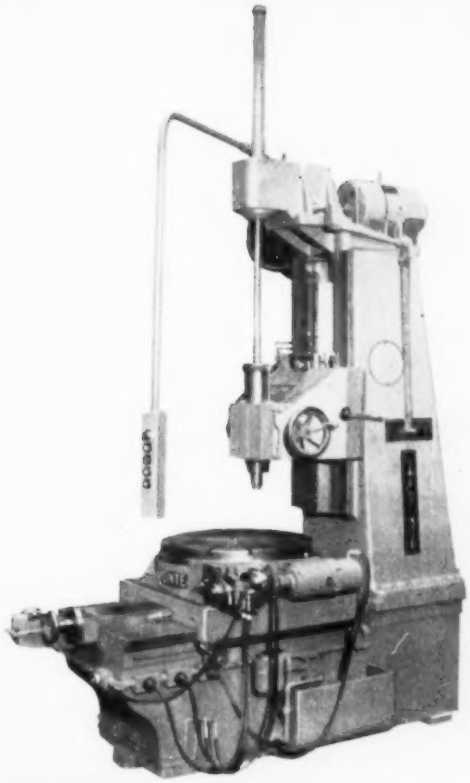
LAPOINTE ROTOMATIC POSITIONER

Accuracy guaranteed within 5 seconds of arc of true position. (Series "A" machine)

In view of the pressing need for a combination rotating table and indexing fixture that would perform with extreme accuracy, Lapointe designed and built this machine in seven standard diameters from 24" to 84". It can take loads up to 25 tons without loss of precision or accuracy; load need not be balanced; machine can start at full load. Can operate by card or tape system.

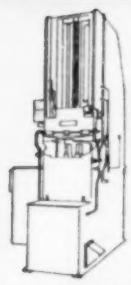
Illustration shows the 48" Lapointe Rotomatic Positioner adapted to a standard radial drill.



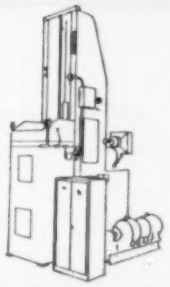


LAPOINTE AUTOMATIC HOLE POSITIONER

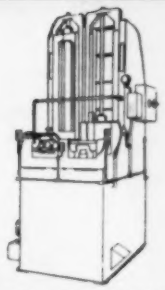
This Lapointe-built machine is unique — it permits the boring of holes anywhere from center to the outside of the table with unprecedented accuracy: 3 seconds of arc of true position. Designed with infinitely variable spindle speeds between 50 and 2000 RPM, the machine is ideal for any manufacturer producing parts with holes equally spaced on any bolt circle. Can be set up for automatic operation, and can be operated by tape control.



VUE-7 VERTICAL PULL-UP ELECTRIC



SRVE SINGLE RAM VERTICAL, ELECTRIC



DRVE DOUBLE RAM VERTICAL, ELECTRIC

LAPOINTE

known to be the best in

BROACHING

CIRCLE 193 READER SERVICE CARD

announcing the most significant hoist development in 25 years!

NEW BALANCED P&H HEVI-LIFT ELECTRIC HOISTS

2,000 to 50,000 pound capacities

a new concept in the application of power and control to hoisting operations

What Is Balanced Design?

Balanced Design means that each part in the new P&H Hevi-Lift hoist has been balanced or matched with every other part for strength, temperature and performance characteristics. *There are no weak parts!* Each part is as strong and dependable as every other part.

As a result, in the new "Balanced Design" P&H Hevi-Lift, no single part is a limiting factor on overall hoist performance. Even under severe duty cycles, motor, gearing and brakes continue to function as designed without excess heating or abnormal wear. It is this unique balance of design and stability of performance that gives the new hoists their name — "Balanced Design P&H Hevi-Lifts."

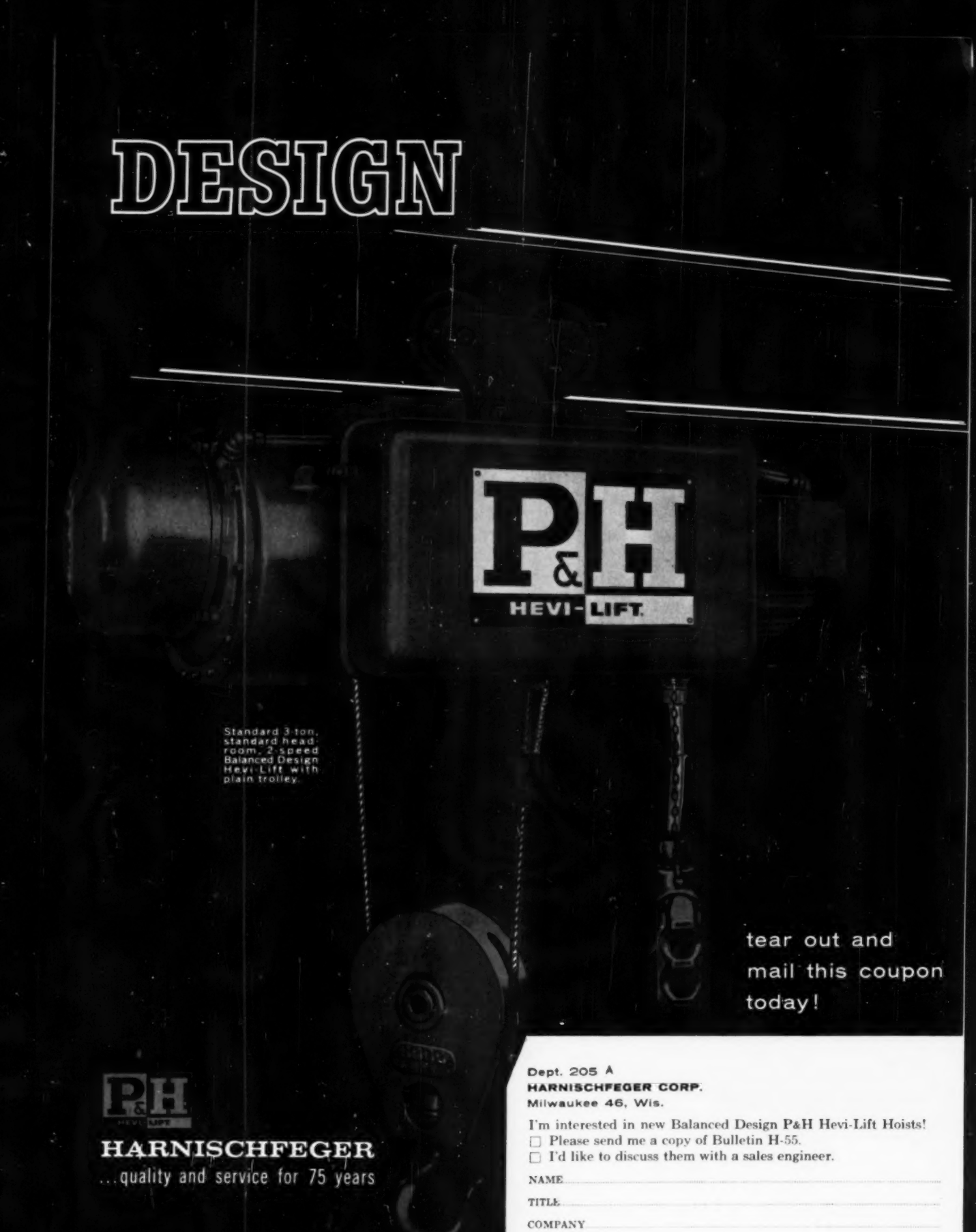
What will new Balanced Design P&H Hevi-Lifts do for you? For one thing, you'll never again be plagued with petty hoist breakdowns that cost pennies to repair, but mean dollars in lost production. Simply stated, *the new Hevi-Lift will stand up longer under heavier duty cycles with less maintenance than any other hoist made today!*

Check These Features

The new Balanced Design P&H Hevi-Lifts are specifically built to provide the solution to every previously existing hoist operating and maintenance problem. For example, they feature: 1) Totally enclosed, weatherproof and dust-proof motor brakes and controls to eliminate maintenance worries, 2) Self-adjusting load brake with extra large linings, oil bath lubricated and cooled, that *never* requires tightening or tinkering, 3) Extra-large, leak-proof design gearcase, with all gears splash lubricated, 4) Lifetime lubrication of all components — there's not a single grease fitting on a Hevi-Lift, and no lubrication headache, 5) Extra-large low-pressure motor brake has only a short 1/32" stroke. There's no punishing hammer action, no pins, linkage or levers—and no need for cooling fans, 6) Alloy steel involute splined shafts and gears of machine tool quality for extra low tooth pressure, long life.

Get the whole story—see the complete line—in Bulletin H-55. Just clip the coupon on the other page and mail it in! Dept. 205, Harnischfeger Corp., Milwaukee 46, Wisconsin.

DESIGN



Standard 3-ton, standard headroom, 2-speed Balanced Design Hevi-Lift with plain trolley.

tear out and mail this coupon today!

P&H

HARNISCHFEGER
...quality and service for 75 years

Dept. 205 A
HARNISCHFEGER CORP.
Milwaukee 46, Wis.

I'm interested in new Balanced Design P&H Hevi-Lift Hoists!
☐ Please send me a copy of Bulletin H-55.
☐ I'd like to discuss them with a sales engineer.

NAME .....
TITLE .....
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...they all prefer PRODUCTO die sets

DIE DESIGNERS
appreciate the *unlimited selection* of die sets which accommodate any type of die design.

DIE MAKERS
like the amazing speed and ease of "take-apart and put-together" made possible by Qwik-Fit Guide Pins. (Safer handling, too.)

PRESSROOM FOREMEN
are convinced that Producto die sets maintain accuracy through long runs, keep production up, downtime down.

CONTRACT SHOP OWNERS
have found consistent die set accuracy, dependable delivery, and smooth performance justifies the confidence with which they specify Producto.

Quick, jam-free assembly and disassembly, lasting accuracy, unlimited selection of sizes and styles! Add to these advantages the benefits of immediate service in every industrial center through Producto's growing network of 46 branch assembly plants and distributor warehouses...and you realize why "They all prefer Producto". • **A WEALTH OF DIE SET INFORMATION** is available to you, free, in the comprehensive, easy-to-use Producto Catalog No. 11, and in regular issues of *Die Set Digest*. Write today for these valuable aids.

THE PRODUCTO MACHINE COMPANY
965 Housatonic Avenue, Bridgeport 1, Connecticut

PRODUCTO

PRODUCE MORE WITH PRODUCTO PRECISION DIE SETS

SKF RACES *Against Time...*

with the

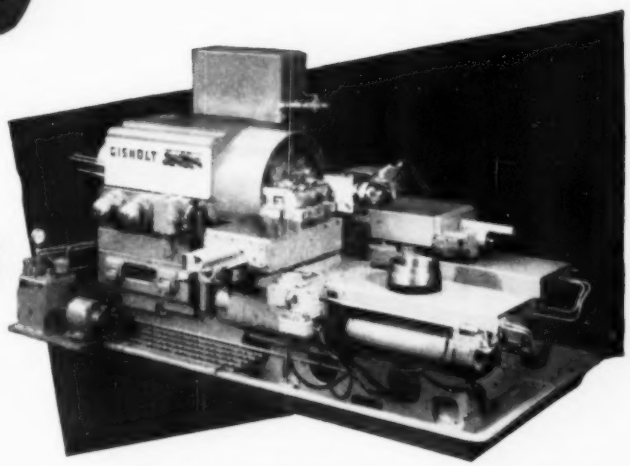
GISHOLT NO. 24 HYDRAULIC AUTOMATIC LATHE

When it comes to fast production of top quality spherical roller bearing races, SKF doesn't fool.

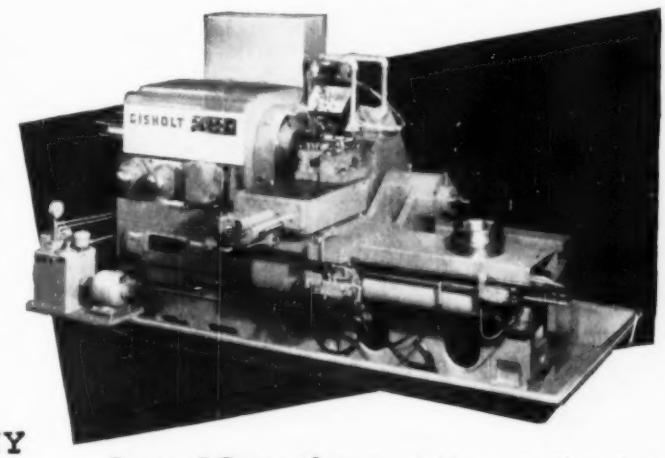
These big Gisholt No. 24 Hydraulics remove 34 lbs. of metal in two operations in a total of only 2.80 minutes' machining time on each of two machines. All cutting is on 52100 bearing steel and done at speeds of 325 to 350 f.p.m.

Speed is important, of course. But precision is the governing factor. How the Gisholt No. 24 does the job is a story that might mean real savings for you, too.

The No. 24 Hydraulic Automatic Lathe is a larger version of the famous No. 12 that has an outstanding success record on hundreds of jobs. If you have large volume precision work up to 24" diameter, the Gisholt No. 24 is the machine to investigate. Write for full information.



First Operation: Chucked on OD with 3-jaw hydraulic chuck, part is turned up to the jaws, faced, chamfered, bored and bore radius formed. Cam relief on rear tool block turns boring bit clear of workpiece as it is withdrawn.



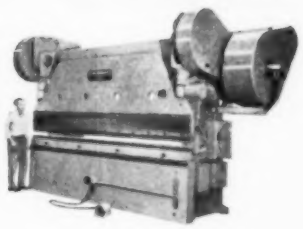
Second Operation: Part held on expanding arbor by hydraulic pressure is finish turned, faced, chamfered and bore radius formed. Special rocker arm type carriage at rear tips in shaving tools to form both roller grooves with feed of .003" to .0045."

GISHOLT MACHINE COMPANY
Madison 10, Wisconsin

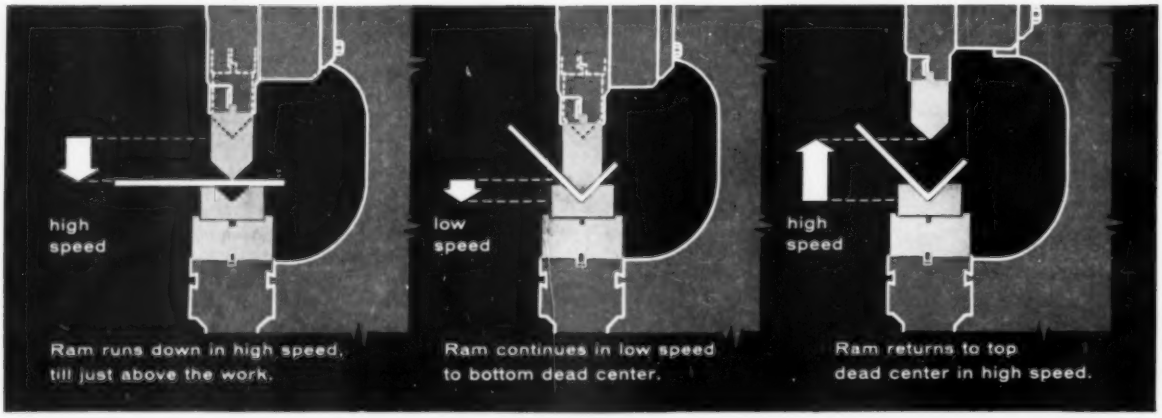
MASTERLINE GISHOLT SINCE 1887 GISHOLT

ASK YOUR GISHOLT REPRESENTATIVE ABOUT GISHOLT FACTORY-REBUILT MACHINES WITH NEW MACHINE GUARANTEE

INCREASE PRODUCTION AS MUCH AS 60% WITH CINCINNATI®



Automatic Cycle Press Brakes


high speed
Ram runs down in high speed, till just above the work.
low speed
Ram continues in low speed to bottom dead center.
high speed
Ram returns to top dead center in high speed.

If you form long, flexible parts, you can increase your production up to 60% with a Cincinnati Automatic Cycle Press Brake.

A new, exclusive feature, the Cincinnati Automatic Cycle provides a combination of instantaneous fast and slow ram speeds with every stroke. As a result, you get maximum production speed without the "whip up" and "back bending" which often occur in high speed forming of long parts which have no beam strength.

You no longer have to rely on the operator's skill at clutch slipping to obtain parts that are free of "back bends."

You can get this money-making feature on all new 7 and 9 Series Cincinnati Press Brakes.

This productive new feature means a lot of advantages for you:

1. Job records show 10% to 60% increase in parts formed per hour.
2. Low speed portion of the ram stroke can be set so that all strokes are identical in length.
3. Rejects caused by "back bends" are stopped.
4. Highly experienced operators are not required.
5. Operator fatigue is greatly reduced because there is no need for clutch slipping.
6. Clutch and brake are long-life, minimum-maintenance units requiring no adjustments.

Write Dept. A for full details about the Cincinnati Automatic Cycle, Bulletin B-9R.

Shapers / Shears / Press Brakes

THE CINCINNATI SHAPER CO.

Cincinnati 11, Ohio, U.S.A.

CIRCLE 198 READER SERVICE CARD

CIRCLE 199 READER SERVICE CARD ►

These workpieces get the "Touch of Gold" in this barrel

. . . Because greater value is added to each product as it is finished with Norton TUMBLEX* abrasives. Let us show you how this "Touch of Gold" can save you money and perform your barrel-finishing and your polishing operations better.

Send in your parts to our Sample Processing Department. We'll finish them using the latest type of tumbling equipment . . . selecting the correct abrasive from our complete line . . . and give you a detailed report on methods and equipment.

Send your parts to NORTON COMPANY, General Offices, Worcester 6, Mass.

*Trade Mark Reg. U. S. Pat. Off. and Foreign Countries

NORTON
ABRASIVES

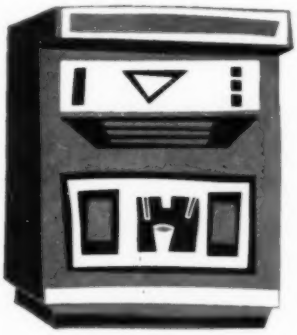
Making better products . . . to make your products better

NORTON PRODUCTS Abrasives • Grinding Wheels • Grinding Machines • Refractories • Electrochemicals — **BEHR-MANNING DIVISION** Coated Abrasives • Sharpening Stones • Pressure-Sensitive Tapes

Looking for a bright idea for your product?

LOOK TO BROWN LIPE CHAPIN

HOME APPLIANCES



VENDING MACHINES

BUSINESS MACHINES

MUSIC & COMMUNICATIONS

An experienced source of decorative and functional die castings and stampings!

Consider Brown-Lipe-Chapin when you're planning ways of adding "hard sell" to your product. Brown-Lipe-Chapin, with extensive facilities for die casting, metal stamping—including steel and aluminum, and electroplating, can help give your product distinctive new eye appeal with a new dimension in durability.

YOU GET A CREATIVE APPROACH

Brown-Lipe-Chapin, experienced in providing the mass-consumer field with quality bright work, takes a creative approach to your design problems. An experienced staff of engineers work out the best and most economical method of producing your parts.

YOU RECEIVE CONSTRUCTIVE ASSISTANCE

You can count on Brown-Lipe-Chapin for constructive suggestions that often add up to savings in time and money. They'll tackle your most difficult part . . . even if it's up to six feet in length. And complete facilities for die casting, steel or aluminum stamping, anodizing, electroplating and painting are all under one roof.

YOU BENEFIT FROM RELIABILITY BY BROWN-LIPE-CHAPIN

You're assured of reliability with Brown-Lipe-Chapin . . . *reliability* in step-by-step quality control, work performed by craftsmen who are experienced in meeting the rigid specifications of the automotive industry . . . *reliability* in meeting your delivery schedules right on time . . . *reliability* in facilities that can be quickly converted to model change-overs . . . and *reliability* as a continued source of supply. Brown-Lipe-Chapin will guarantee to supply your requirements for die casting and stamping for as long as you may want to specify.

Brown-Lipe-Chapin's two plants, in Syracuse, New York and Elyria, Ohio, combine 25 acres of modern plant facilities that are ready to go to work for you now. So, before the die is cast on your product designs, contact Brown-Lipe-Chapin, Division of General Motors Corporation, Syracuse, New York.

GM GENERAL MOTORS

RELIABILITY by BROWN·LIPE·CHAPIN

DIVISION OF GENERAL MOTORS CORPORATION

A PRODUCT OF SKILL

BUTTERFIELD
100%
INSPECTED
TOOLS

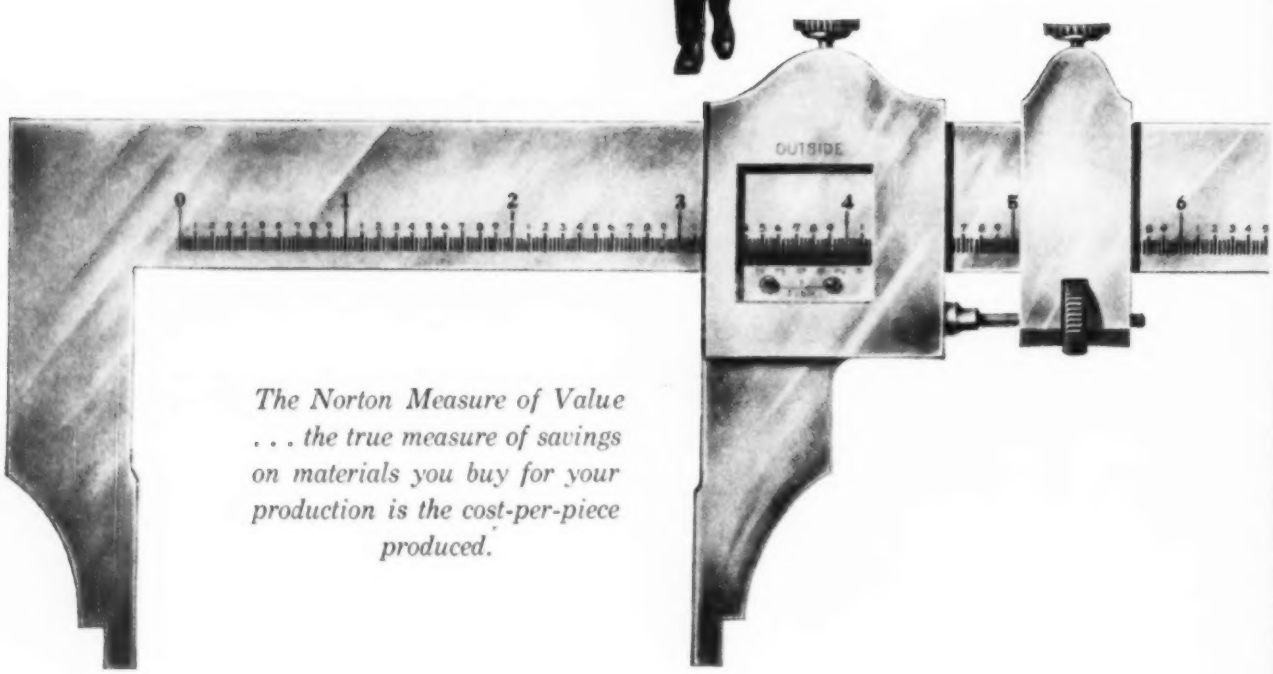
the complete line

You can get Butterfield quality-produced reamers, drills, taps, dies, counterbores, cutters, end mills, hobs and carbide tools in quantity when and where you want them. Warehouses in Chicago, Cleveland, Detroit, Fort Worth, Los Angeles, New York and San Francisco.
Call your Butterfield Distributor.

BUTTERFIELD

BUTTERFIELD DIVISION,
UNION TWIST DRILL COMPANY, DERBY LINE, VERMONT

Call your Norton Man — he has the experience, the products, and knows how to save you money where it counts. There's a Norton expert in the fields of — abrasives, grinding machines, refractories.



The Norton Measure of Value . . . the true measure of savings on materials you buy for your production is the cost-per-piece produced.

Economists could argue the definition of the value of a grinding wheel in many ways. But it would usually come down to this — What is it worth to the purchaser.

You can buy less expensive grinding wheels than Norton wheels and save on immediate cost. But if the lower cost wheels do not perform their jobs efficiently or cause production delays because of poor quality or wheel misapplication — you haven't made a bargain — you've made a costly mistake.

The only accurate measure of the value of a grinding wheel is how much it produces for you per dollar cost — not merely how much you paid for it. Here is why Norton grinding wheels are worth more to you —

Norton Company gives you the most advanced research engineering and manufacturing facilities in the entire abrasive field — and you get this great scope of detailed knowledge on a personal basis — your Norton Man.

Every Norton Man starts his career by spending a minimum of one year in a carefully planned training course in the Norton plant and a comparable period of training in the field to assure a broad, thorough understanding of grinding before he goes "on his own." The average experience of all Norton Men in the field is 15 years in addition to their specialized training. The Norton Man is the most knowledgeable man in abrasives that you can consult. Make him your consulting abrasive engineer.

He will make an Abrasive Requirement Study for you.

You can produce

than you can buy

This study lists the correct specifications for each abrasive job in your plant to assure you lowest cost-per-piece produced. He is also available for complete field testing on specific problems.

For example, your Norton Man can increase production by pointing out ways for better wheel usage and fewer wheel changes. He has the widest selection of grinding wheels in the industry from which to select the best wheel for new product grinding operations and for improving your current grinding jobs — both at the lowest cost. And with Norton grinding wheels you can be sure of precise duplication order after order.

Norton offers true abrasive economy. Economy that pays off in lower cost-per-piece produced. Call your Norton Man. NORTON COMPANY, General Offices, Worcester 6, Mass.

W-1893

NORTON
ABRASIVES

Making better products... to make your products better

"Top" Brass for Lenox China Cuts Polishing Costs 20%

Where kings and presidents dine . . . and in your own home . . . you'll probably find beautiful Lenox China. Among the more striking pieces in the Lenox line are unique salt shaker and pepper mill sets made of fine china, in patterns that match Lenox dinnerware. Topping off these lovely pieces are gold-plated caps stamped from Bridgeport High Luster Brass Strip.

At one time polishing operations accounted for 60% of the total cost of these caps. Today, using Bridgeport High Luster Brass Strip, Lenox has cut these costs a whopping 20%! And blanking, stamping, punching and plating are easier with this finely finished standard quality Bridgeport strip.

Do you use strip metal in your products? Learn how High Luster Brass Strip can reduce your costs. Call your nearest Bridgeport Sales Office, or write direct for literature. Dept. 3007.

matched
Bridgeport **Metals**
to your job

BRIDGEPORT BRASS
Bridgeport Brass Company, Bridgeport 2, Connecticut
Sales Offices in Principal Cities

HARDINGE
ELMIRA, N.Y.

MASTERS and PADS

FOR BETTER PERFORMANCE — BETTER PRODUCTION

AND

PROFITS

STYLE "S"
MASTER COLLETS and PADS
The Only Master Collet with
No Work Pressure On The Screw
Available For: Cleveland-Cone
Greenlee—Gridley and Acme-Gridley
National Acme—New Britain
Warner & Swasey

Write for FREE Bulletins

STYLE "B"
MASTER FEED FINGERS and PADS
Pads Cannot Work Loose
No Screws — No Pins
Available For: Brown & Sharpe
Cleveland—Cone—Davenport—Greenlee
Gridley and Acme-Gridley—National Acme
New Britain—Warner & Swasey

Carried in Stock For Prompt Delivery at:

Elmira, Boston, Atlanta, New York, Hartford, Philadelphia, Rochester, N. Y., Dayton, Detroit, Minneapolis, Chicago, St. Louis, Oakland, Los Angeles, Toronto, Montreal

HARDINGE BROTHERS, INC., ELMIRA, N. Y.

Gets finer finishes, reduces lapping time, boosts

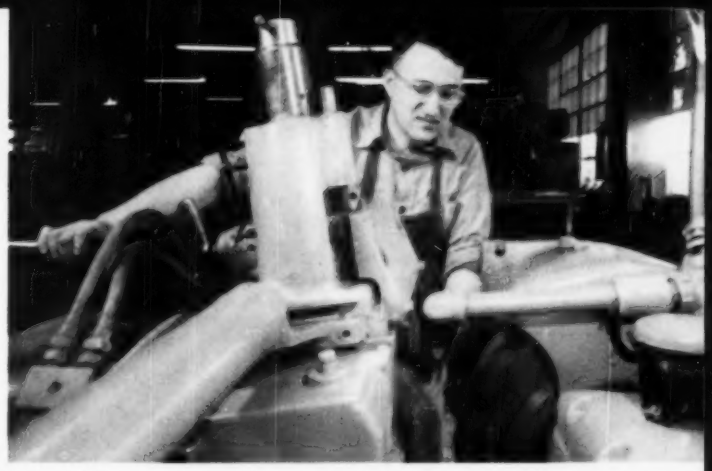
GULF MAKES THINGS

"Before we switched to Gulfcut Heavy Duty Soluble Oil, our previous emulsions had permitted ground finishes of about 11 micro-inches on valve components. Now we average 6 to 8 micro-inches. As a result, we have reduced lapping time to a minimum and improved production more than 10%."

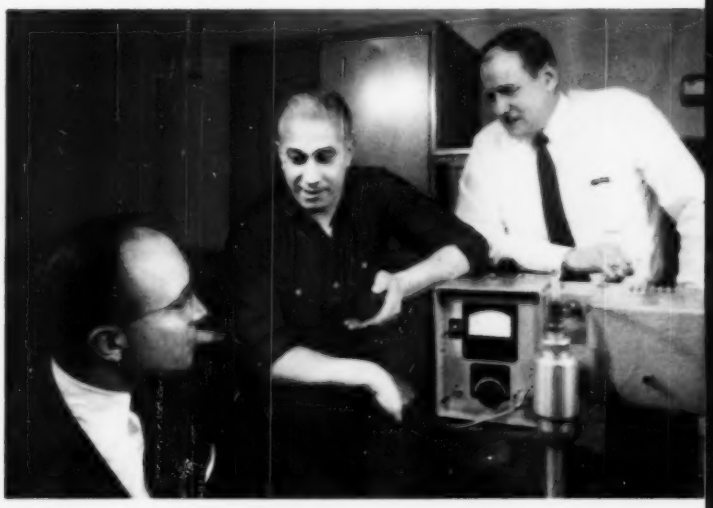
So reports Mr. Charles Grillo, Machine Shop Foreman at the Hancock plant of Manning, Maxwell & Moore, Inc., Watertown, Mass. The company is a leading manufacturer of valves, gauges, electronic process controls, hoists, cranes, and a wide variety of other precision-built equipment for industry. Their Hancock plant produces "Hancock" bronze and steel valves (some with component tolerances of +.0000" to —.0005"), and other products for the chemical, petroleum and power industries.

"We not only get superior finishes with Gulfcut Heavy Duty Soluble Oil," says Mr. Grillo, "but we find this oil so versatile that we use it on many jobs where we never used emulsifying oil before.

"We also find that Gulfcut Heavy Duty Soluble Oil



Grinding a 2" steel gate valve stem (Type 970) on a centerless grinder at Hancock plant of Manning, Maxwell & Moore, Inc.—where Gulfcut Heavy Duty Soluble Oil is the coolant. Work piece is of 416 steel, "300 Brinell" hardness.



Checking a 5 to 6 micro-inch finish on a steel gate valve wedge, are, left to right, Mr. R. M. Drennan, Gulf Sales Representative, Mr. Charles Grillo, Machine Shop Foreman, and Mr. B. W. Morrison, Quality Control Superintendent at the Hancock plant.

Grinding 2" Type 970 steel gate valve wedges on a surface grinder at Hancock plant of Manning, Maxwell & Moore, Inc. Shields removed and operation suspended to show grinding wheel and work pieces in place on stock table.

production 10% using Gulfcut . . .

RUN BETTER!

has no unfavorable reactions with the various metals we use, including bronzes, brasses, monels, chrome and stainless steels, Stellite and others. We no longer have any problems of rancidity. No objectionable odors when working brass or bronze. No staining or corrosion of non-ferrous metals."

May we have the opportunity to demonstrate this cost cutting product? See how Gulf makes things run better. Call a Gulf Sales Engineer at your nearest Gulf office. Or mail coupon for illustrated bulletins.

GULF

GULF OIL CORPORATION
Dept. DM, Gulf Bldg., Pittsburgh 30, Pa.
Send bulletins on ☐ Gulfcut Heavy Duty Soluble Oil ☐ Gulfcut "regular" oils.

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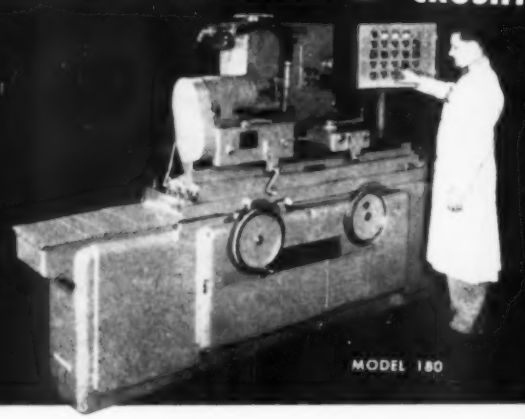
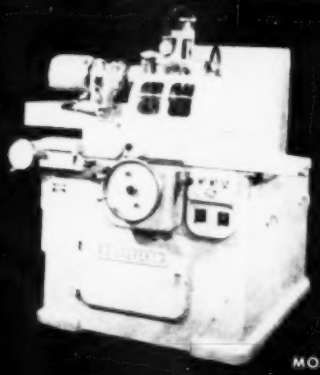
Title _____
Company _____
Address _____
City _____ Zone _____ State _____

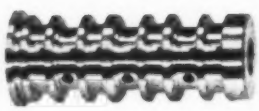
Grind PRECISION FORMS, GROOVES and LANDS *in Record Time* with SHEFFIELD'S CRUSHTRUE MULTIFORM GRINDERS

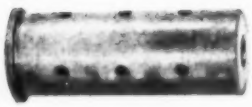


MODEL 180



MODEL 109





Servo Mechanism Sleeve

The seven grooves of this servo mechanism sleeve are crushtrue ground from the solid to a tolerance of .001" on spacing and .002" on minor diameter in 55 seconds. Material, SAE 52-100; Rockwell, 58-60 C; depth of plunge grind, .145".

Forms and grooves are precision ground on these machines with comparable speed and economy.

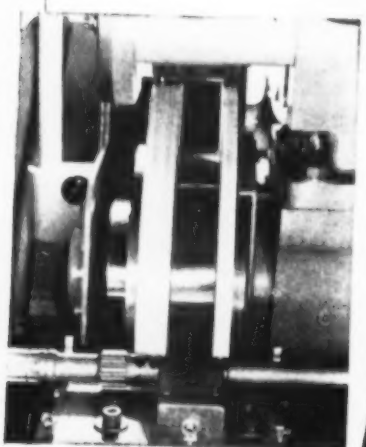
For complete details write to Department 1, The Sheffield Corporation, Dayton 1, Ohio, U.S.A.

Bearing Race

Aircraft Servo Component

Hydraulic Servo Units

Self-aligning Bearings



Grinding Grooves in a Transmission Shaft

Crushtrue Roll

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the **SHEFFIELD** *corporation*

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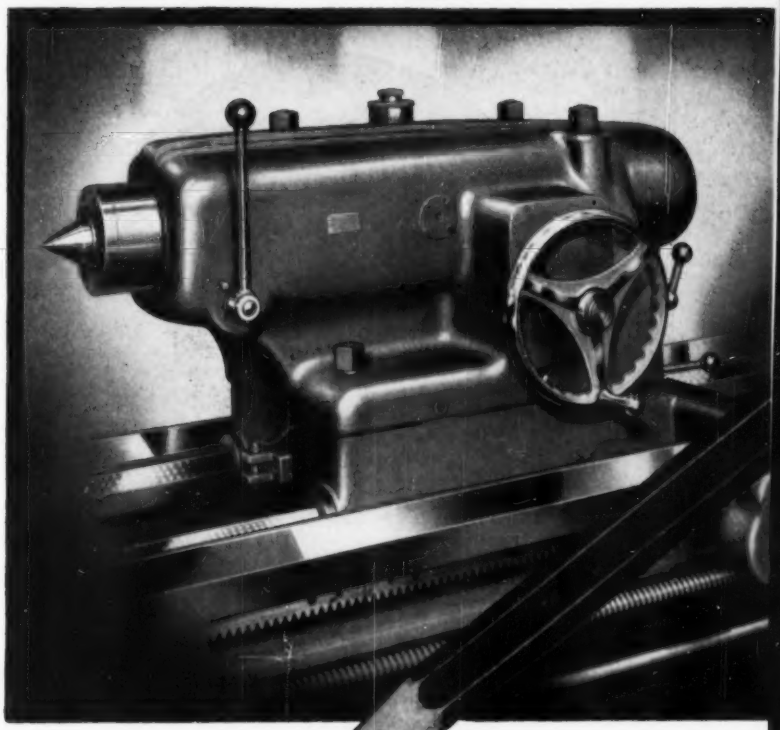
manufacture and measurement for mankind

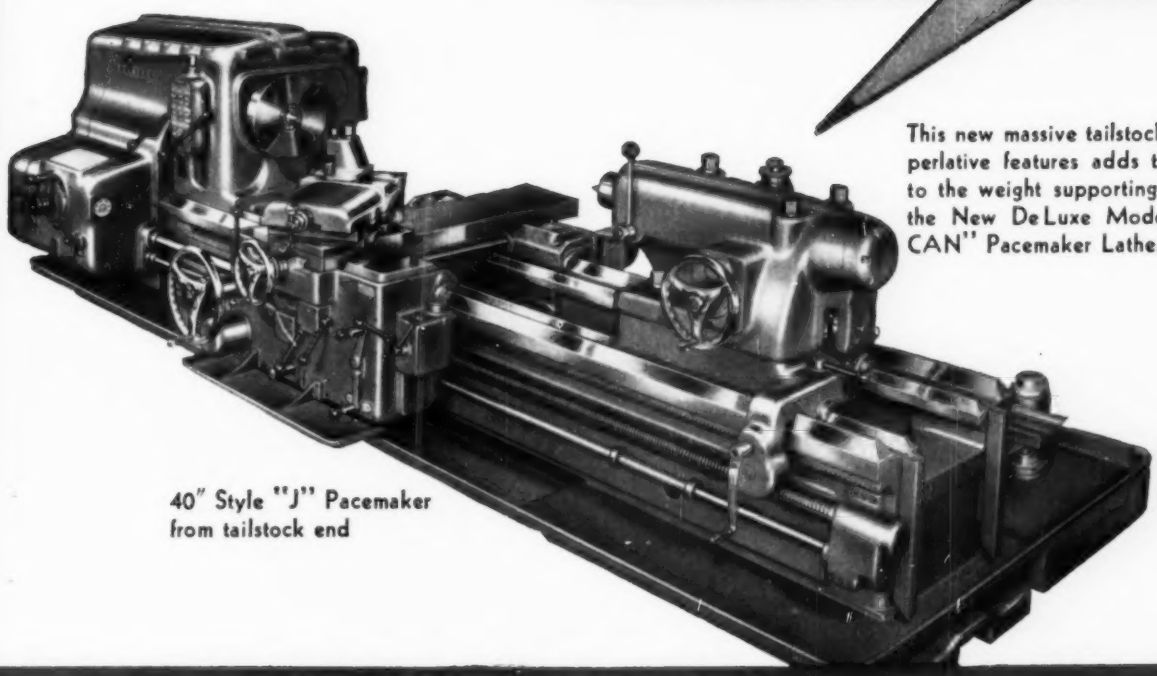
STOP LOOK Compare



This new mammoth SUPER TAILSTOCK now furnished on "AMERICAN" De Luxe Model 32" Style "I" and 40" Style "J" Lathes has . . .

- 7½" Diameter Spindle—Long Travel
- Unparalleled Rigidity
- Circular Depth Dial—Easily Read
- Built in Single and Two-Speed Types
- Convenient Front Controls
- Either Stationary or Ultra Capacity Built-in Anti-Friction Center
- Both Manual and Power Movement along Bed
- Plunger Pump Oiled including Bed Ways

Send for Bulletin No. 144 for complete details.



40" Style "J" Pacemaker from tailstock end

This new massive tailstock with its superlative features adds tremendously to the weight supporting capacity of the New De Luxe Model "AMERICAN" Pacemaker Lathe.

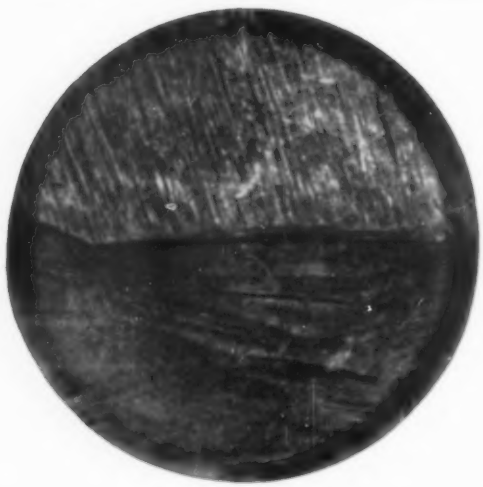
THE AMERICAN TOOL WORKS CO. Cincinnati 2, Ohio, U. S. A.

LATHES AND RADIAL DRILLS

CIRCLE 209 READER SERVICE CARD

Republic Cold Drawn Carbon Corrected Bars

BOOST PRODUCTION, IMPROVE QUALITY, MINIMIZE REJECTS



Note the result of induction hardening in the cutaway view at left of a piston pin fabricated from Republic C-1050 Cold Drawn Carbon Corrected and Annealed Bars.

A piston pin manufacturer was experiencing production difficulties and dissatisfaction with pin quality from a performance standpoint.

A Republic 3-Dimension Metallurgical Service Team was invited to work on the problem. A field metallurgist visited the plant. He talked to production men and engineers. Found out what they expected the steel to do. He then reported back to the mill and laboratory metallurgists. The three men discussed the problem, pooling their combined knowledge of steels and machining.

Their final recommendation was a switch from plain cold drawn bars to Republic C-1050 Cold Drawn Carbon Corrected and Annealed Bars. The results were immediate. Production increased substantially. Pin quality improved to the highest level.

The company is also enjoying better machinability and is saving both metal and money by eliminating waste. Carbon Corrected Bars eliminate the extra preparation of machining or grinding away bar surface to remove "decarb." The Carbon Correction Process also eliminates the need for buying bars oversize to allow for decarb removal to depths of 20 thousandths of an inch or more.

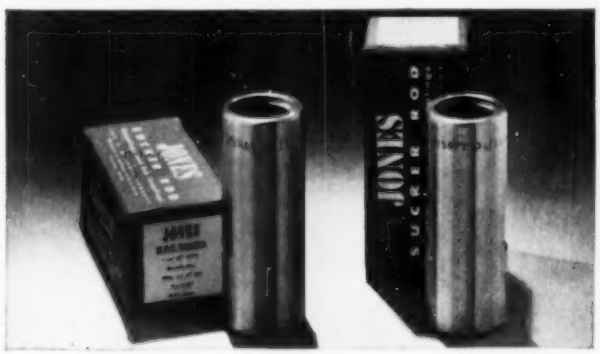
Republic Cold Drawn Carbon Corrected Bars are ideally suited for your steel parts requiring high surface hardness —particularly those produced by induction heating.

For more information on Republic Cold Drawn Carbon Corrected Bars, or obligation-free 3-D Metallurgical Service, mail the coupon.

GRADER BLADE MANUFACTURER LEVELS OFF COSTS WITH REPUBLIC HOT ROLLED SPECIAL BAR SECTIONS. Shunk Manufacturing Company, Bucyrus, Ohio, has maintained top-quality and its competitive position for over 30 years by using Republic High Carbon Hot Rolled Special Bar Sections for grader blades. The special bar sections are preformed to the predominating cross section of the blade, thus keeping costs down by eliminating most machining and forming operations. Republic Special Bar Sections are available hot rolled or cold drawn in carbon, alloy, and stainless steel. Send coupon for full facts.

YOU GET MORE TUBE PER DOLLAR with Republic ELECTRUNITE® Hydraulic Fluid Line Tubing. Available in all sizes shown in JIC Standards Book. Available in an even wider range of sizes produced to our specification HL-1 (which meets all test requirements of JIC standards). Utmost uniformity assures better bending and flaring characteristics, appreciable savings in downtime. In the *history* of ELECTRUNITE Hydraulic Fluid Line Tubing, no failure resulting from longitudinal or transverse cracks has been reported. Send for complete ELECTRUNITE information, including a copy of specifications.

REPUBLIC COLD FINISHED ALLOY STEEL BARS PROVIDE GREAT STRENGTH, PRECISE TOLERANCE at reasonable cost in the production of sucker rod couplings. The parts must withstand enormous static and dynamic loads, to more than 40,000 psi. Essential to designing smaller sections to carry heavier loads safely is the outstanding combination of qualities provided by alloy steels. Then add the advantages of the cold finishing process . . . you have a material that offers strength, hardness, machinability, size and close-sectional accuracy, smooth bright surface, and close tolerance straightness. Mail coupon for more information.



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Please send more information on:
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☐ ELECTRUNITE Hydraulic Line Tubing
☐ Cold Finished Alloy Steel Bars

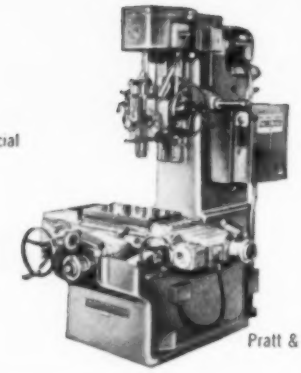
Name _____ Title _____

Company _____

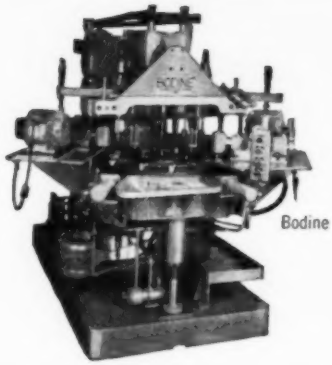
Address _____

City _____ Zone ____ State _____

Hartford Special



Pratt & Whitney



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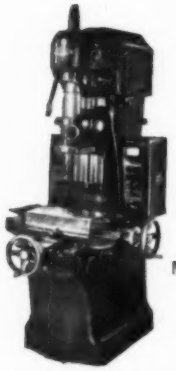
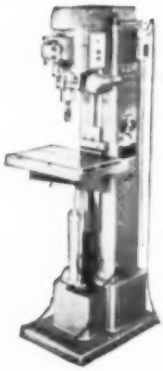
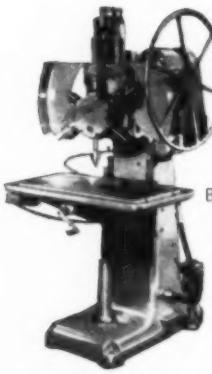


Moore

Dumore



Snow



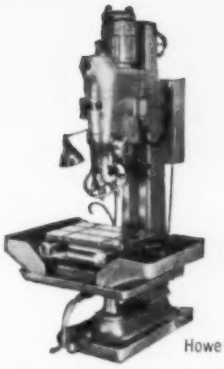
Burg

Leland-Gifford

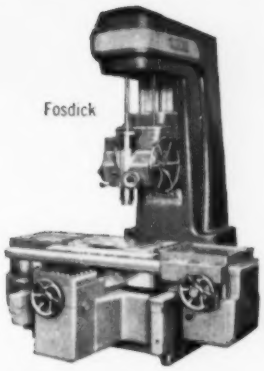
CIRCLE 212 READER SERVICE CARD

American

Edlund

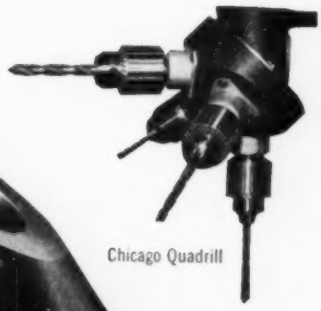


Howe & Fant



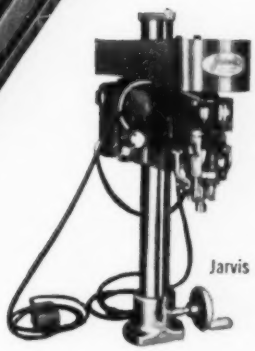
Fosdick

Jacobs CHUCKS



Chicago Quadrill

Commander



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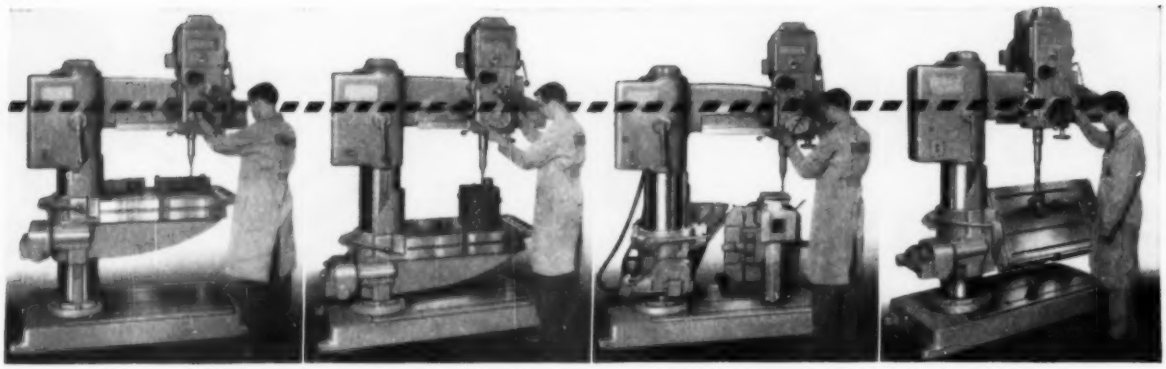
A PARTNERSHIP IN PROGRESS

Your industrial supply distributor makes it his business to know your business. He is always available and ready to fill your needs quickly, dependably and economically. When you need chucks, you can depend upon Jacobs and the Jacobs industrial supply distributor who works with you . . . your partner in progress through service.

THE JACOBS MANUFACTURING COMPANY, WEST HARTFORD, CONNECTICUT

CIRCLE 213 READER SERVICE CARD

no reaching....
or crouching....
for any job....



WITH A FOSDICK SENSITIVE RADIAL DRILL

You can drill holes up to 1½", in small or large work—*all from the same normal operating position* on this unique machine.

The Fosdick Sensitive Radial Drill is another in a long line of Fosdick "firsts." It fills the gap between the Radial and Sensitive or Upright Drill, gives you exceptional versatility, *plus* operator convenience never possible before.

The arm of this machine—always at the same height—swings 360°. The table, which moves up and down on the one-piece column, also swings 360°. It may be provided with the tilting feature illustrated. A machine base is provided for work too large for the clearance between spindle and table.

Get the whole story on this unique machine. Its moderate price and outstanding features will mean more profitable drilling in your shop. Call your Fosdick Distributor today or write for Bulletin SRA.

THE FOSDICK MACHINE TOOL CO., CINCINNATI 23, OHIO

RADIAL DRILLS
SENSITIVE AND UPRIGHT DRILLS
JIG BORERS & GRINDERS
NUMERICAL CONTROL PRECISION BORING MACHINES
SENSITIVE RADIAL DRILLS

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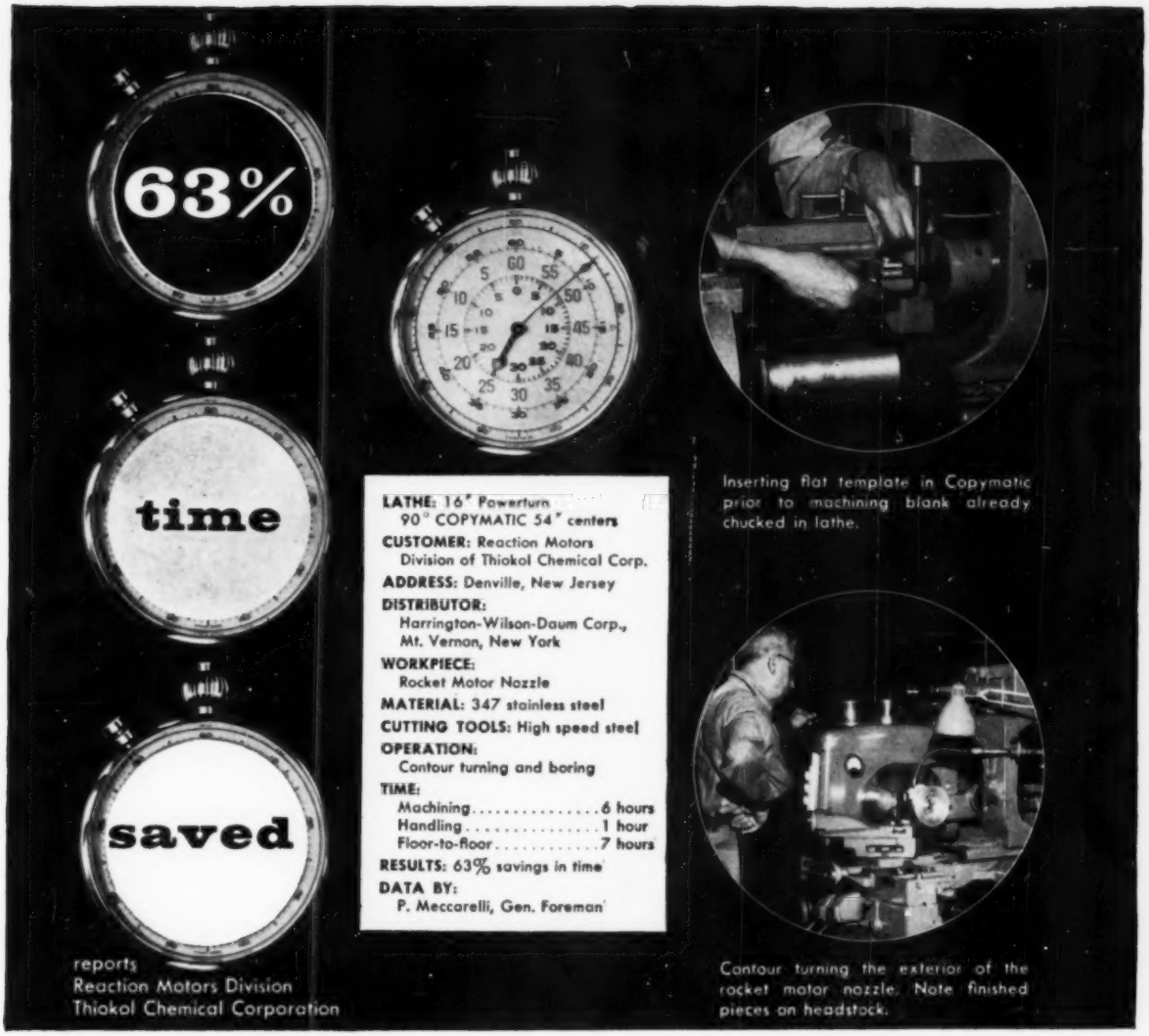
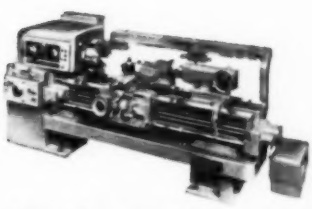

63%
time
saved
reports
Reaction Motors Division
Thiokol Chemical Corporation
LATHE: 16" Powerturn 90° COPYMATIC 54" centers
CUSTOMER: Reaction Motors Division of Thiokol Chemical Corp.
ADDRESS: Denville, New Jersey
DISTRIBUTOR: Harrington-Wilson-Daum Corp., Mt. Vernon, New York
WORKPIECE: Rocket Motor Nozzle
MATERIAL: 347 stainless steel
CUTTING TOOLS: High speed steel
OPERATION: Contour turning and boring
TIME:
Machining . . . . . 6 hours
Handling . . . . . 1 hour
Floor-to-floor . . . . . 7 hours
RESULTS: 63% savings in time
DATA BY: P. Meccarelli, Gen. Foreman
Inserting flat template in Copymatic prior to machining blank already chucked in lathe.
Contour turning the exterior of the rocket motor nozzle. Note finished pieces on headstock.

by this Lodge & Shipley Powerturn Copymatic Lathe



A pioneer in jet propulsion, Reaction Motors Division of Thiokol Chemical Corp., Denville, N. J., plays an important part in America's rocket defense and space exploration programs. In turn, and in turning, a Lodge & Shipley POWERTURN COPYMATIC plays an important part in rocket motor production.

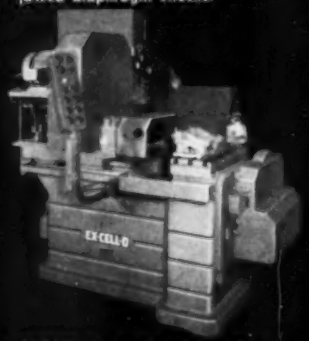
In contour turning and boring a typical reaction motor nozzle, the COPYMATIC cuts 12 hours from the previous time, completing the job in 6 hours machine time and one hour handling time.

Whether you're machining the new and tougher alloys or the old stand-by metals, you'll appreciate the strength, rigidity and extra power available in Lodge & Shipley Lathes. For special jobs or routine operations, the speed and accuracy of these world famous lathes offers much to virtually any lathe user.

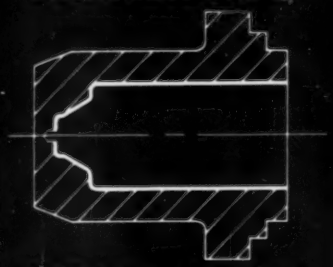
Investigate the time and money-saving possibilities of Lodge & Shipley COPYMATIC Lathes with 45° or 90° tracer slides. Contact your Lodge & Shipley representative or write for literature:
The Lodge & Shipley Company, 3056 Colerain Ave., Cincinnati 25, Ohio

More than ever before, your LODGE-ical choice . . . **Lodge & Shipley**

LEFT—Closeup photo shows the .003" radius boring tools and the size of the parts held in the three-jawed diaphragm chucks.



ABOVE—The Style 308 Cam-Operated Precision Boring Machine used in this high-output machining operation.



ABOVE—Cutaway, twice actual size of the part, shows contour of the finished cut. Surface finish is held to 12 RMS.

59-20

BORES AND CONTOURS 184 PARTS PER HOUR

Style 308 Cam-Operated Precision Boring Machine finishes small stainless steel parts to 12 RMS

Speed and precision in continuous, close-tolerance production of contoured parts come easy to this Ex-Cell-O Cam-Operated Precision Boring Machine. Direct cam action makes it possible. Two cams are mounted on a single shaft; one acts directly on the cross slide follower, the other on the table follower. There are no levers. Changing the cams changes the form for the next job—in minutes.

Style 308 (illustrated) and the larger Style 312 hold the parts in one or more spindles, tools are mounted on the cross slide. The machine above uses such a setup to straight-bore and generate the inside contour of 184 parts per hour, two at a time.

If you are anxious to get a similar production process underway quickly and economically, start now by calling your local Ex-Cell-O Representative. Or, if you prefer, write direct.

EX-CELL-O FOR PRECISION XLO

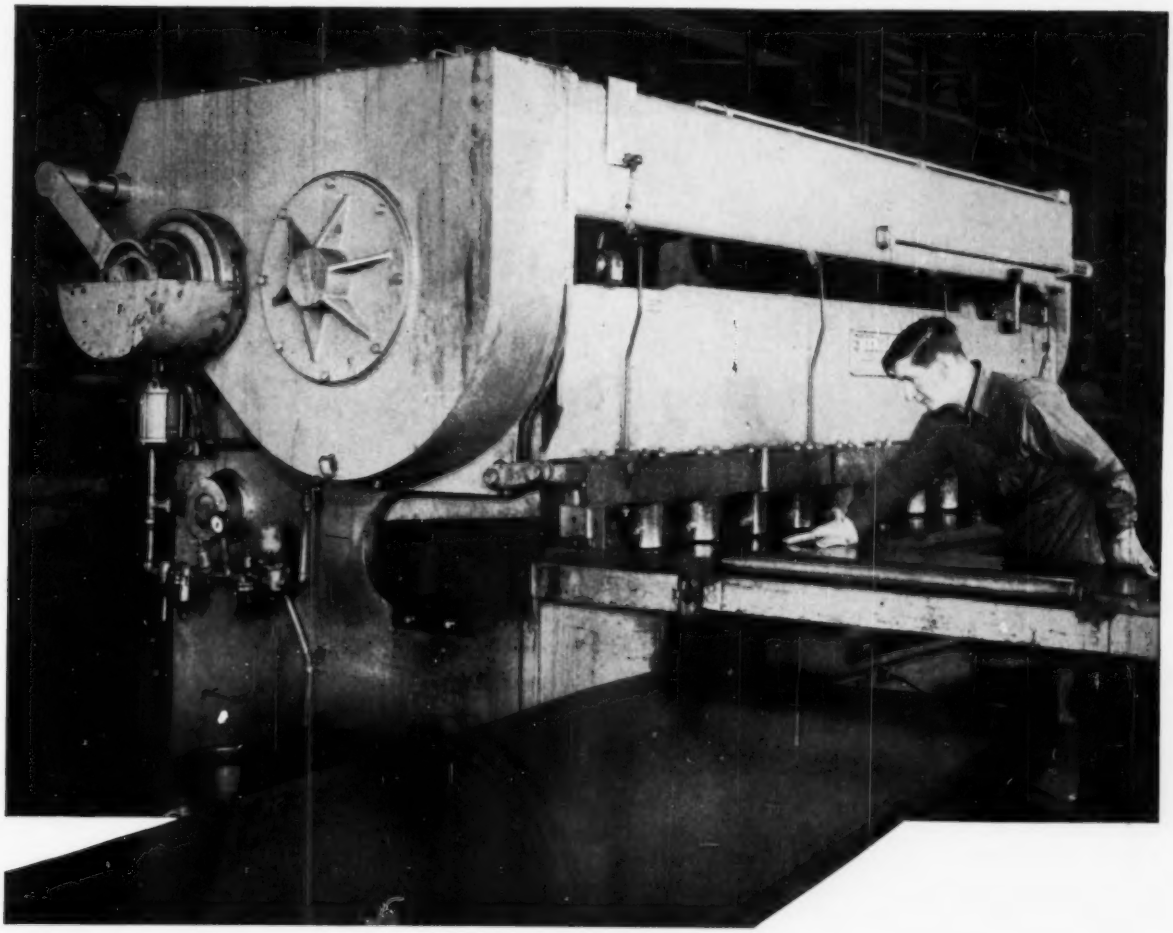
EX-CELL-O CORPORATION Machinery Division

DETROIT 32, MICHIGAN

EX-CELL-O PRECISION PRODUCTS INCLUDE: MACHINE TOOLS • GRINDING AND BORING SPINDLES • CUTTING TOOLS • RAILROAD PINS AND BUSHINGS • DRILL JIG BUSHINGS • TORQUE ACTUATORS • THREAD AND GROOVE GAGES • GRANITE SURFACE PLATES • AIRCRAFT AND MISCELLANEOUS PRODUCTION PARTS • DAIRY EQUIPMENT.

CIRCLE 316 READER SERVICE CARD

.002 inch clearance between knives produces sharp, straight, accurate edges in the 18 gauge metal cut on this Steelweld Shear. The clearance is easily increased to suit heavier metal. The shear operator is not confined to some average compromise clearance.



Cuts 1200 PIECES Per Hour

Farm Equipment Manufacturer Gets Sharp, Accurate Cuts Because of Steelweld's Exclusive Knife Clearance Adjustment

MASSEY-HARRIS-FERGUSON, Ltd., Toronto, well known throughout the world as a leading manufacturer of farm implements does much of the cutting required for the various steel parts with Steelweld Shears.

Massey-Harris-Ferguson obtains the best possible cuts because the knife clearance can be adjusted exactly to suit the thickness of metal being cut. It is not necessary to depend upon some compromise difficult-to-change knife setting with Steelweld Shears, as they are easily adjusted to the correct clearance in 10 seconds.

Illustrated is one of the many cutting jobs for which Steelwelds are used. 108-inch lengths of 18 gauge steel are cut into six 18-inch pieces at a rate of 1200 per hour. Knife clearance setting for this work is .002 inch. This shear has been in operation 24 hours a day, six days a week, for many years.

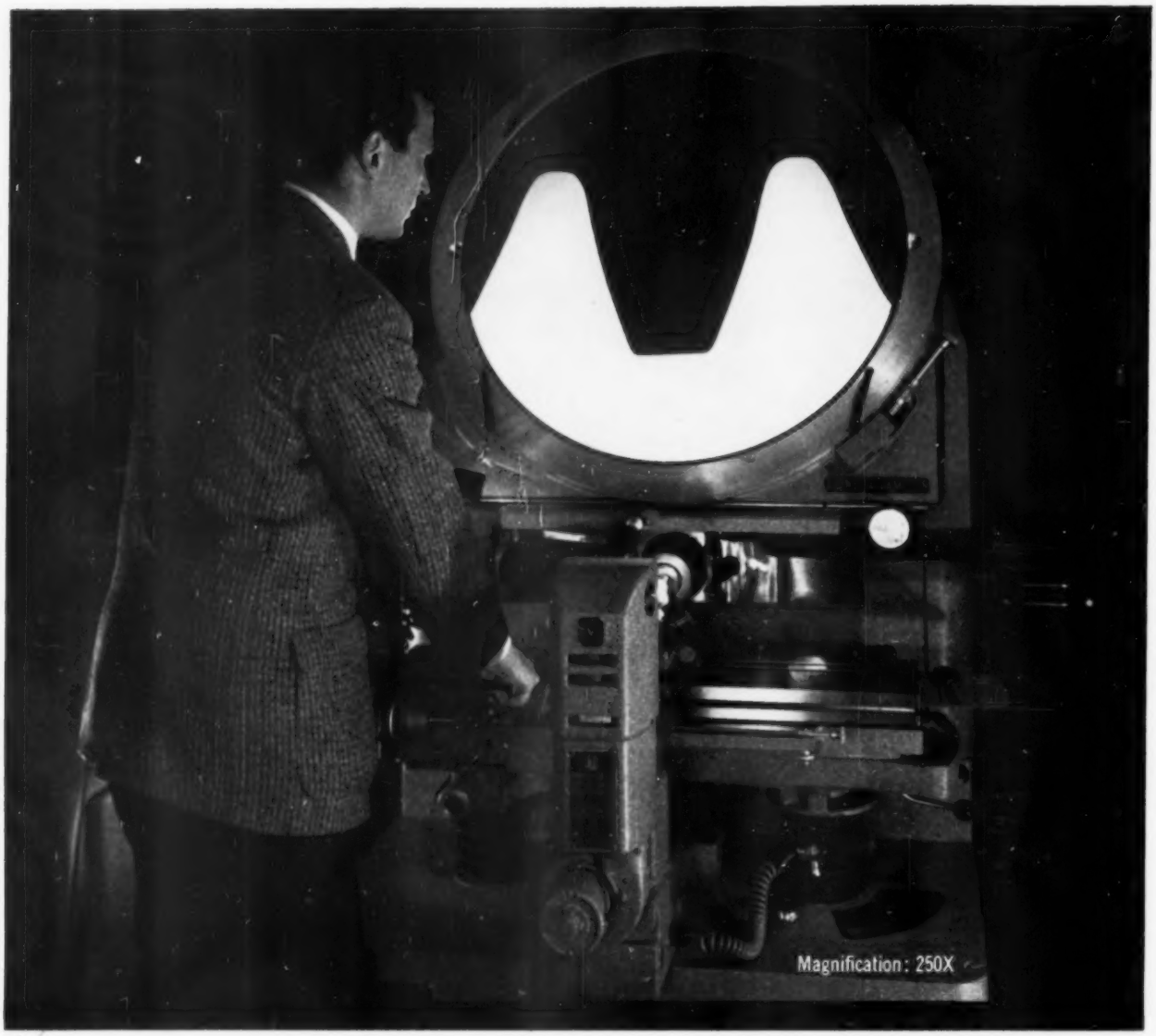
Write for free copy of Catalog No. 2011
Gives construction and engineering details

STEELWELD

PIVOTED BLADE **SHEARS**

1456 East 282nd Street, Wickliffe, Ohio

STEELWELD DIVISION • THE CLEVELAND CRANE & ENGINEERING CO. • 1456 E. 282nd ST. • WICKLIFFE, OHIO



See the sharpness of the shadow produced by a Mercury Arc Lamp!

This photo shows the sort of shadow you get with a Mercury Arc Lamp. Note the extreme sharpness of the shadow image's definition, even at 250 magnifications. This unprecedented sharpness means greater precision, greater efficiency in your inspection and measurement operations.

◀ Note the actual size of this gear, which is enlarged for inspection on the FC-30 Comparator screen. Gear has 57 teeth, and has 1.1159" dia. base circle.

IMPORTANT NEWS

for all users of J & L Optical Comparators!

Jones & Lamson introduces the J & L MERCURY ARC LAMP

. . . a revolutionary new light source

that makes your optical inspection more precise,

more efficient than ever before!

This new J & L light source unit gives *more than 5 times the intensity of the best filament light source available today.*

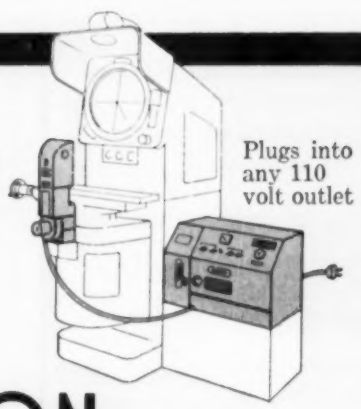
The light produced by the J & L Mercury Arc Lamp is actually a *new* kind of light . . . **you get a *steady* arc, with *no* flickering.** Its high intensity produces an incomparably bright screen with razor-sharp black shadow even at highest magnifications. Thus, accuracy of inspection and measuring is increased enormously. Now, you can literally "split tenths" with your J & L Comparator! (For use at low magnifications, the Mercury Arc light can be filtered readily.)

The J & L Mercury Arc Lamp comes as a complete packaged unit that is quickly interchangeable with the standard light source on any J & L 14-inch and 30-inch Comparator. This compact unit is a universal device to take various standard makes of mercury arc lamps.

For detailed information and specifications, or a demonstration, get in touch with your local Jones & Lamson representative, or write direct to Jones & Lamson Machine Company, Springfield, Vermont.

Jones & Lamson, the originator of optical comparators, proudly announces the J & L Mercury Arc Lamp, a remarkable development that tremendously improves and enhances the efficiency and precision of J & L 14-inch and 30-inch screen Comparators, old or new.

Interchanges with regular lamphouse in minutes.



Plugs into any 110 volt outlet

JONES & LAMSON

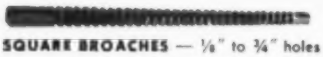
502 Clinton Street, Springfield, Vermont, U. S. A.

STANDARD BROACHES from STOCK

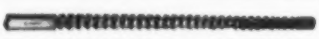
Minute Man
KEYWAY BROACH KIT

In one minute and for as little as one cent you can cut a keyway with the Minute Man Keyway Broach Kit. For keyways from 1/16" to 1" in any bore from 1/4" to 3".

SAVE TIME AND MONEY WITH THESE OTHER STANDARD STOCK BROACHES



SQUARE BROACHES — 1/8" to 3/4" holes



HEXAGON BROACHES — 1/8" to 3/4" holes

ROUND BROACHES — 1/4" to 1" holes

SEND FOR CATALOG AND PRICE LIST

The duMont Corp.
Greenfield, Mass.

MAIL FREE BROACH CATALOG AND PRICE LIST **A** describing Square Broaches, Hexagon Broaches, Production Type Keyway Broaches and Keyway Broach Kits to

Name.....

Company.....

Address.....

duMont

Letters...

To American Machinist
330 W 42nd St, NY 36, NY

Dermatitis manual

Dears Sirs:
What is the address of the Industrial Hygiene Foundation of America, Inc, or the American Medical Association? We'd like to obtain 200 copies of your article on Dermatitis (*AM*—Apr 20 '59, p107) or the original article prepared by the Industrial Hygiene Foundation. We prefer your article as people are so busy today that the less reading to do to get the facts, the better.

I might mention the fact that so often when companies or organizations are mentioned in trade magazines, the complete address is seldom given in the article even as a footnote. This causes delay when anyone wants to contact the one written about. How are the chances of something being done in this direction by publishers of trade publications?

C A Sluhan
Toledo, Ohio

The manual, "Good Plant Practice for Workers Using Petroleum Products," is being distributed by the American Petroleum Institute through its members and should be available from most suppliers of cutting oils. Therefore, we did not believe it practical to publish an address—or list of addresses—in this article.

Usually, we do give the city when we refer to a company, and in new equipment and new literature listings we give both the street and the city.

Of course, we are always glad to quote prices for reprints of AM articles, and a quotation has been sent to Reader Sluhan—Ed.

New Material

Dear Sirs:
Would you please elaborate on the item on DuPont's new Delrin plastic (*AM*—Feb 9 '59, p4)

Under the heading of "Materials & Components" you state that Delrin is castable in conventional zinc die-casting dies. Am I to assume this means the material is suitable for use in die-casting machines?

I A Carr
Brockton, Mass

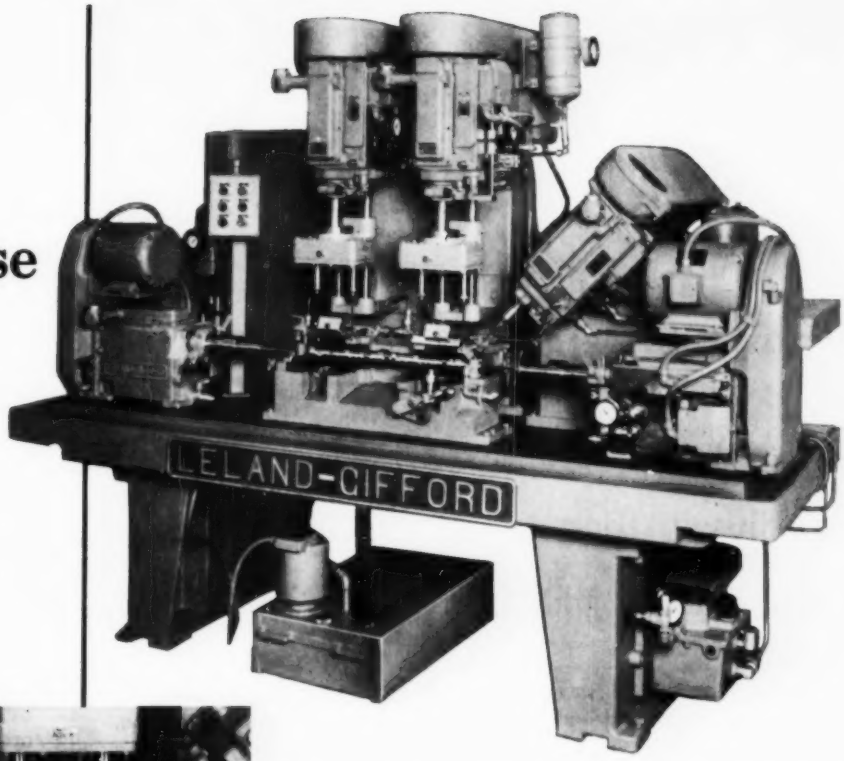
The material is suitable for use in die-casting machines with modification of equipment. DuPont is

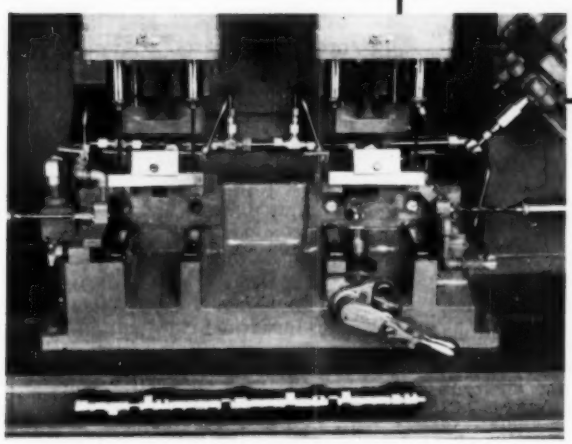
SHOPMATES

N. Jarvis

THE JOBS THAT MAKE THE MUSCLES HURT ARE ALWAYS HANDED TO MAC SQUIRT...
WHILE SLEDGE MAC HAMMER, SUPER BOY, GETS JOBS YOU TURN OUT ON A TOY!!
N. JARVIS

Here's an idea you can use to cut precision drilling costs....





One machine, one handling, one quick, simple operation does all the precision drilling on this camshaft. Note that this is not ordinary gang drilling — the job involves axial, angular and cross holes as well as reaming.

Leland-Gifford has time-saving, cost-cutting ideas for you, too — ways you can combine multiple operations into a simple, efficient unit operation.

THE JOB: Drill one end of camshaft and ream the other while drilling four cross holes and one angular oil hole.

THE MACHINE: A Leland-Gifford special with five No. 2 self-contained units and standard hydraulically clamped fixture interlocked with drilling units to start feed after clamping and to unclamp when operation is finished. SC units are interlocked to prevent interference between cross and axial drills. One operator completes 60 camshafts per hour at 100% efficiency.

For Automatic Drilling at its best be sure to see Leland-Gifford

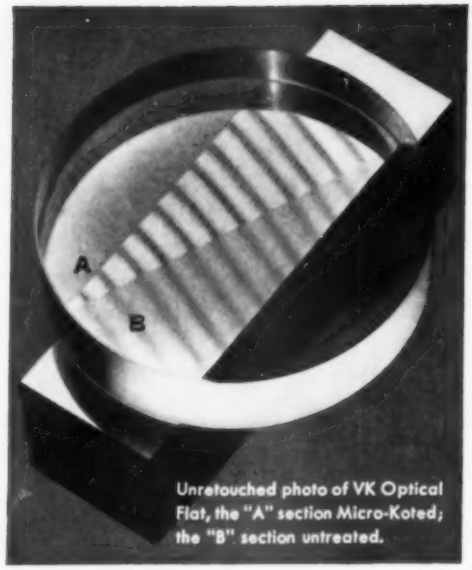
CALL THE OFFICE NEAR YOU

LELAND-GIFFORD SPECIAL DRILLING MACHINES

WORCESTER 1, MASSACHUSETTS
U. S. A.

Chicago 5
2515 W. Peterson Ave.
Detroit
10429 W. McNichols Rd.
Cleveland 22
P. O. Box 853
New York Office
75 S. Orange Ave
South Orange, N.J.
Los Angeles Office
2620 Leonis Blvd.
Vernon 58, Cal.
Indianapolis 6, P. O. Box 1051
Rochester 12, P. O. Box 24, Charlotte Station

Checking surface flatness **down to 1/10 of a band?** (.000001-inch) You can do it easily with the



Unretouched photo of VK Optical Flat, the "A" section Micro-Koted; the "B" section untreated.

VAN KEUREN MICRO-KOTED* OPTICAL FLAT

Elimination of the fuzzy edges of the interference bands gives you *greater precision* and *readability* . . . and faster checking, too, because you get the pattern quicker. There's stronger contrast, a brighter field. The narrow band, very black and sharp-edged, has a width corresponding to a height difference of about .000001".

Having several times the effectiveness of ordinary flats, you might think that VK Micro-Koted Optical Flats are expensive — but that's where you'd be wrong. They cost only 10% to 15% more than uncoated flats. They do not require special handling; they have amazingly long life. One user checked more than 10,000 pieces of permanent magnetic material (carbon seals and Alnico seals) without any appreciable wear. Speaking of VK Micro-Koted Flats, one man said, "It makes a hell of a difference! We wouldn't buy a flat *unless* it was Micro-Koted!" That's the kind of compliment that makes us do our best!

Originated by Van Keuren in 1957, these Micro-Koted flats are perfect for checking bronze, brass and other metals used for magnetic seals, and for checking other critical parts, for surface flatness.

Write today for descriptive leaflet, "Micro-Koted Flats".

* VK Micro-Koted Optical Flats are treated on one side with a transparent layer of hard metal.

VK

THE Van Keuren CO.
Since 1920
173 Waltham Street, Watertown 72, Mass.
PRECISION MEASURING TOOLS
. . . rated the world's most accurate
Plug Gages · Measuring Wires · Optical Flats and Light Wave Equipment · Gage Blocks · Precision Lapping Service and Parts

your best source of information for further details: Mr Harry Cates, Delrin, E I Du Pont de Nemours, Wilmington 98, Del—Ed.

0 000,002 in. is important

Dear Sirs:

We read with interest the additional comments made on the international Inch (*AM*—Mar 23, '59, p137).

However, our comment is not correct in saying, "The fact that any dimensional reading up to 0.020 in. is off by 0.000,002 in. is of no practical consequence." This *would* be of practical consequence, especially in the manufacture of instrument bearings where an error of 0.000,002 in. is extremely important.

The actual error in a 0.020-in. travel would be 0.000,000,04 in., and our statement should have read, ". . . errors of 0.000,000,04 in. are of no practical consequence."

While one of our customers is using the Profilometer to check production parts with average roughness values in this range, we have pointed out that this is only a comparative reading, and we do not guarantee absolute calibration at this level.

American Machinist is to be congratulated on the fine job it is doing to acquaint the engineers and shop men with advances in gaging. In particular, the forum on roundness measurement and the forum on the international inch are outstanding.

Edgar W Bolles
Micrometrical Manuf Co
Ann Arbor, Mich

We have printed this letter with the long decimals marked off by commas so that readers (and proofreaders) can keep track of the zeros more easily—Ed.

CALENDAR

Pressed Metal Institute—National Meeting, Sept 13-17, Stanley Hotel, Estes Park, Colo.

Society of Automotive Engineers—Farm, Construction and Industrial Machinery Meeting and Display, Sept 14-17, Milwaukee Auditorium, Milwaukee, Wis.

American Die Casting Institute—Annual Meeting, Sept 15-17, Edgewater Beach Hotel, Chicago, Ill.

Instrument Society of America—Instrument - Automation Conference & Exhibit, Sept 21-25, Int'l Amphitheater, Chicago.

American Welding Society—National Fall Meeting, Sept 28-Oct 1, Sheraton-Cadillac Hotel, Detroit, Mich.

Society of Automotive Engineers—National Aeronautic Meeting and Display, Oct 5-10, Ambassador Hotel, Los Angeles, Calif.

American Society of Tool Engineers — Semi-annual Meeting, Oct 8-10, Chase-Park Plaza Hotel, St. Louis, Mo.

American Society for Testing Materials — Pacific Area National Meeting, Oct 11-16, Sheraton Palace Hotel, San Francisco.

Magnesium Association — Annual Convention, Oct 19-20, Hotel Roosevelt, New York, NY.

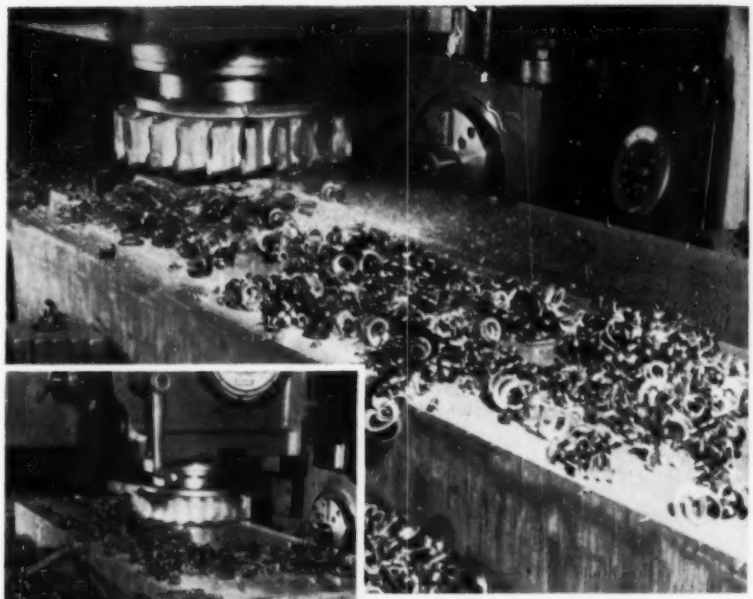
American Institute of Electrical Engineers—Machine Tool Conference, Oct 19-21, Hotel Cleveland, Cleveland, Ohio.

American Machine Tool Distributors Association — Annual Meeting, Oct 25-27, Statler Hotel, St Louis, Mo.

American Gear Manufacturers Association — Semi - Annual Meeting, Oct 25-28, Edgewater Beach Hotel, Chicago, Ill.

American Society for Metals—National Metal Exposition and Congress, Nov 2-6, International Amphitheatre, Chicago, Ill.

National Tool & Die Manufacturers Association — Annual Convention, Nov 4-8, Statler-Hilton Hotel, New York, NY.



1/16" finish cut. Note fine surface finish, a result of true running, flywheel cutting action.

Cutter at completion of roughing cut. 1/2" stock removal. Note efficient, uniform chip formation.

1/2" STOCK REMOVAL on part of MISSILE LAUNCHING PAD AT ONE PASS!

. . . Another Outstanding NELCO Carbide Tipped Tooling Application

And that's not all . . . the 1/2" roughing cut at 14" per minute feed and the 1/16" finishing cut at 20" per minute feed were made with the *same "standard" off-the-shelf cutter.* The operations are performed on a 50 H.P. Gray Planer Mill, the tool is a NELCO 12" face mill for steel.

This versatile cutter has extremely heavy brazed carbide tips to withstand shock and interrupted cuts. Exceptional cutter weight gives flywheel effect and insures superior heavy stock removal and extremely fine surface finishes.

Send for Cutting Tool "Condensalog" with prices on 3300 "Standard" profit improving cutters to: *Cutting Tool Division, Brown & Sharpe Mfg. Co., Providence 1, Rhode Island.*

Brown & Sharpe

CUTTING TOOL DIVISION

HIGH SPEED STEEL CUTTERS

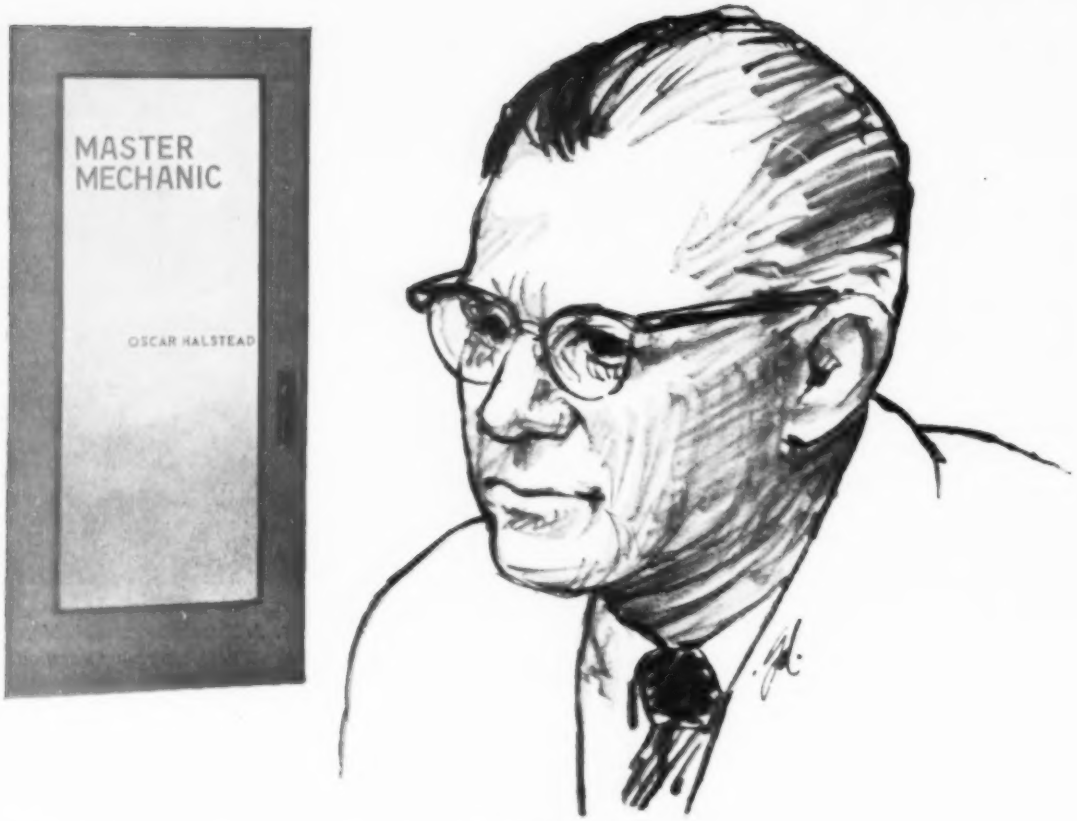
NELCO CARBIDE TOOLS

END MILLS

FOR THAT EXTRA EDGE IN PRODUCTION

INDUSTRIAL DISTRIBUTORS THE RIGHT HAND OF PRODUCTION

CIRCLE 223 READER SERVICE CARD



"I'm responsible for $4,000,000 in machine tools"

"Don't let anybody tell you this field hasn't changed. The days when you could throw a print at a machinist and get the job done are all gone. With the controls and instrumentation on today's equipment, you've really got to know your way around. I depend on technical magazines to keep me a jump ahead of the new developments."

Oscar Halstead isn't alone in this feeling. While he's a hypothetical example, he's representative of the production management in today's $120 billion Metalworking industry. Staying ahead of today's fast-moving technology is no simple task. Not when you're charged with a big job of keeping production humming in the plant.

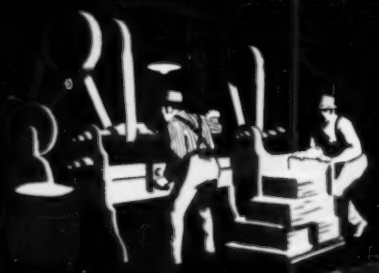
American Machinist is published to help Halstead's real-life counterparts. Our job is keeping them posted; giving them the know-how that's so important in their jobs. Because American Machinist covers *all* types of Metalworking plants and *all* production processes in those plants, it's "must" reading. That's why so many men in Metalworking say . . .

"I have to read American Machinist"

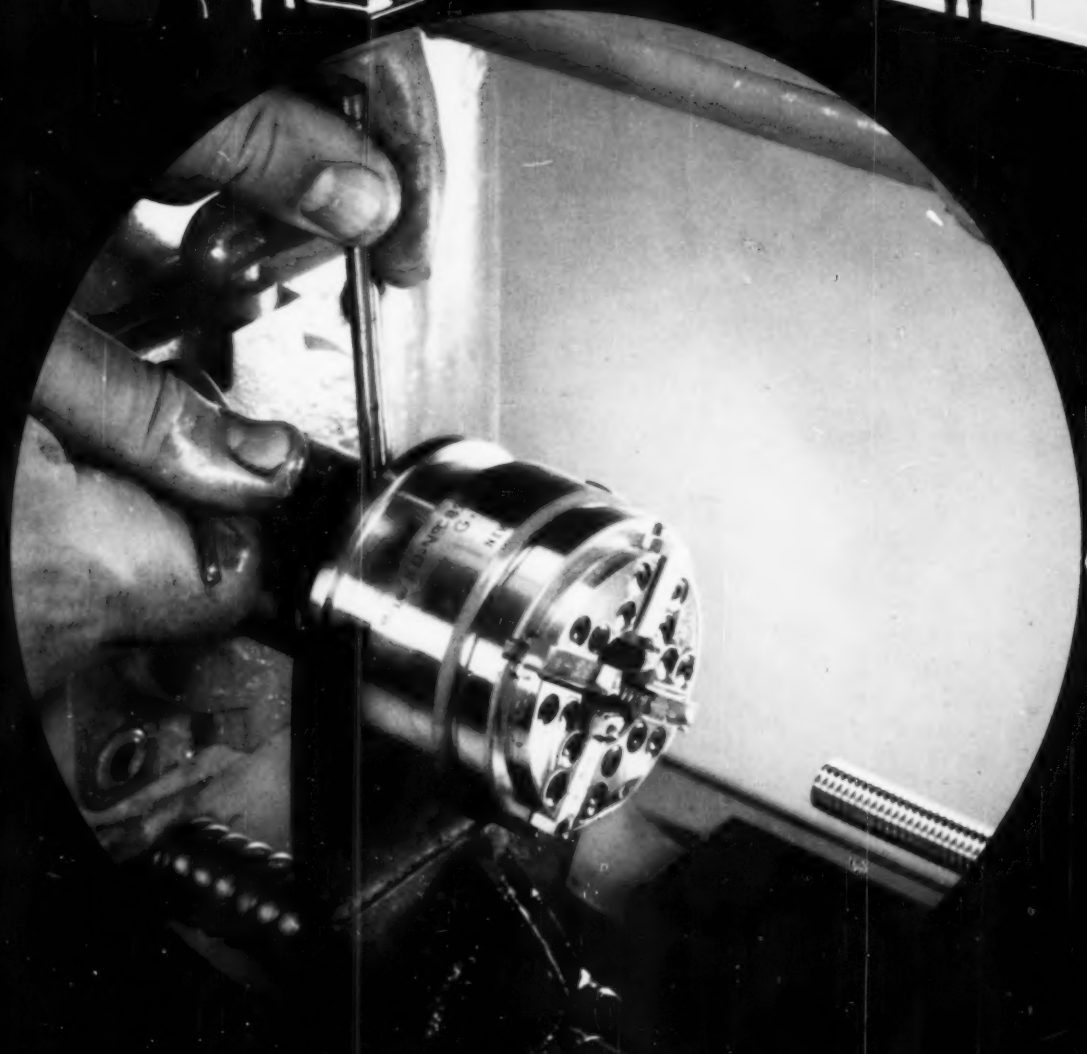
McGraw-Hill Magazine of Metalworking Production
330 West 42nd Street, New York 36, New York

CIRCLE 225 READER SERVICE CARD ►

GEOMETRIC Die Heads were born in a plant like this, and some of those ancient heads are still operational.



But with this streamlined Giant? We're sorry – you can still find some worn out or pretty old die heads even in them!



GEO MET RIC

You may "get by" with antique or worn out tooling, but you won't get ahead. Don't hold down those new, expensive automatics with out-of-date or worn die heads. A machine tool is only as good as its cutting tools. Give it a break. Give it a NEW GEOMETRIC.

CALL YOUR GEOMETRIC DISTRIBUTOR TODAY

GEOMETRIC – HORTON

NEW HAVEN 15, CONNECTICUT

Where 100% is not Perfect

Thread strength tests clearly show that any increase in the percentage of thread height over 60% does not materially increase the strength. For the vast majority of tapped holes 55% to 75% thread is adequate. Rarely, if ever, will a 100% thread height be economical or desirable.

For a complete discussion of this point, and dozens of others which affect threading results, write for "Facts About Taps and Tapping" — the tapping *handbook* by GREENFIELD.

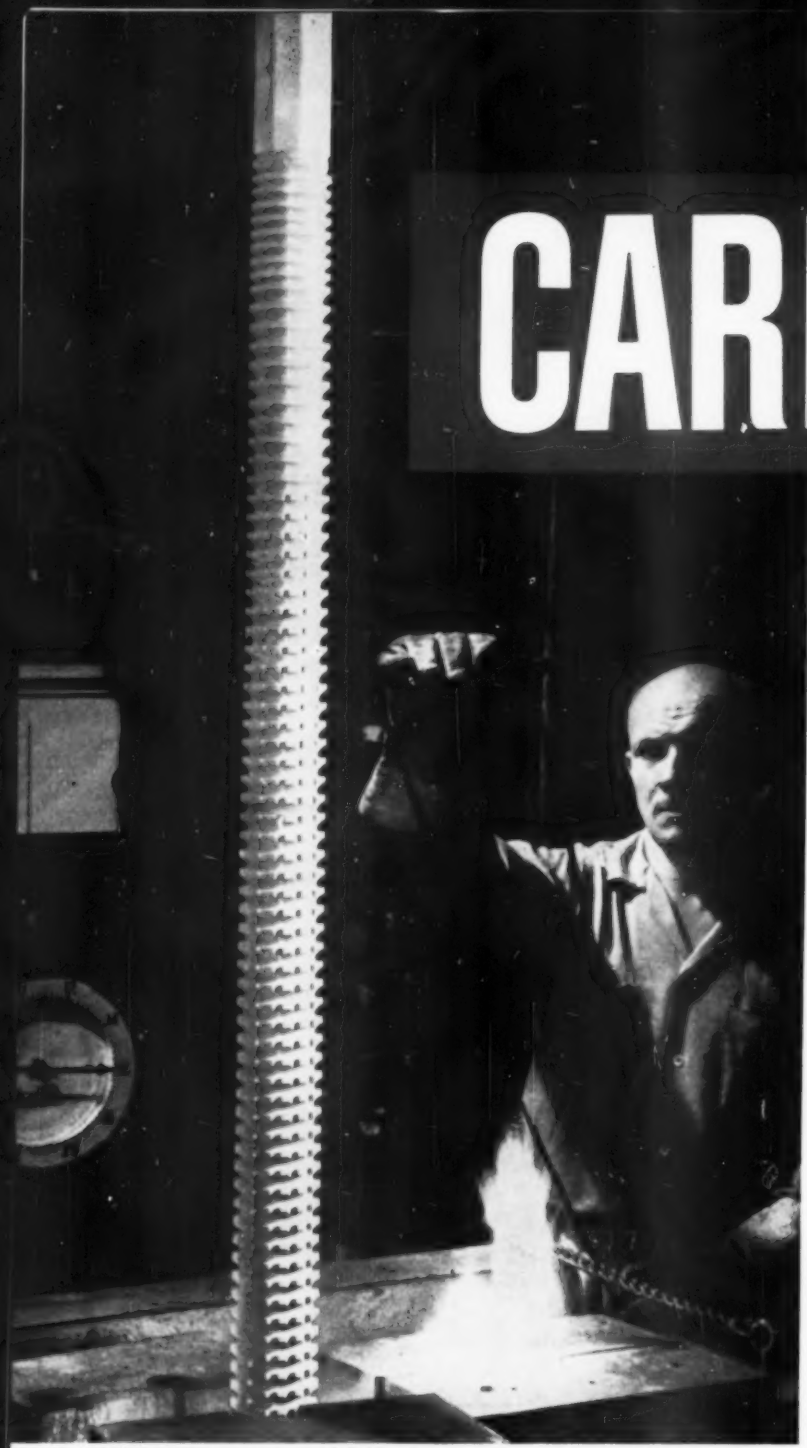
INDUSTRIAL DISTRIBUTION
SERVING INDUSTRY ECONOMICALLY
THE RIGHT HAND OF PRODUCTION

GREENFIELD TAP & DIE GREENFIELD, MASS.

SPOT NEWS...

- **Look for Ford and GM to build U S-style small cars in Canada.** Ford will have two such cars, just different enough to satisfy its two separate dealer networks there. Chrysler's Valiant will also be made in Canada.
- **Russians are now cutting metal with a burner that uses ordinary kerosene** and medium-pressure oxygen. Unit is used in quantity cutting of low-carbon steel sheet and plate of 3 to 100-mm thickness. With different burners, it can weld cast iron, cut nonferrous metals, and some steel sheet.
- **Short run piercing costs are said to be cut 60 to 90% with "Templamation,"** a new system developed by Weidemann Machine Co. With it, semi-skilled workers can make templets to ± 0.002 in. at a rate of 100 or more holes per hr (on a coordinating machine), inspect templets to ±0.001 in. at a rate of 100 to 150 holes per hr (on an inspection machine), and use the templets to locate and pierce holes to ± 0.005 in. at from 30 to 60 strokes per min on a turret punch press equipped with follower gage.
- **Bottom surface of aluminum sandwich on tail section of the Atlas missile** is now vacuum gold plated to protect it against blast-off heat (about 6000 F). The gold film is only 3 to 4 millionths of an inch thick.
- **Look for a speedup in R & D for the Army's Nike Zeus anti-ICBM project**—an additional $157 million has just been added to the initial $300-million Zeus budget for the new year. Actually this means that Zeus will get the lion's share of $200 million tacked on to the Army's allotment for both the Zeus project and "general hard goods production."
- **Enough foreign steel is now coming through the St Lawrence Seaway** to offset possible strike-created shortages in the Cleveland area, an industry source in that city claims.
- **Aircraft and missile contracts made up 49.7% of all defense contracts** let in calendar 1958—compared with only 39.6% in calendar 1957. Heading the list of top contractors for 1958: Boeing, General Dynamics, General Electric and Lockheed—the same ranking as they held in 1957. Biggest changes among the top 100: Chance Vought, down from 12th to 65th place; Chrysler up from 20th to 12th; United Aircraft down from 5th to 14th place.
- **A cold box for cold treatment of metals** (down to –260 F) is now commercially available from a Swiss firm. The 14-cu-ft box has a refrigerating capacity at –150 F of 4440 Btu/hr: at –250 F of 2560 Btu/hr.
- **Manufacture of printed circuits by vacuum coating** is being researched by National Research Corp and other firms. Goal is to print transistors, diodes and other gear along with the circuit itself. Numerical tape control unit will automatically govern the deposit.
- **National Auto Show will be revived in fall of 1960** (October 15-23) in Detroit—the first time the Show has ever been held in the motor capital.
- **A $525,000 contract for investigation of high-temperature metals** for possible use by builders of satellites has been awarded to Lockheed-Marietta (Ga). Two-year program calls for determination of fatigue limit of four new titanium alloys at temperatures ranging from normal to 900 F.
- **Individual mounting patterns for each of five basic machine tool sizes** (a new recommendation of the Machine Tool Builders Standardization Committee) are expected to be adopted as standard by Ford soon, with GM, Chrysler, International Harvester and other advocates of "building block" machine tools following suit (see p81).

CAREFUL!



With the sure, *careful* touch of an experienced hand, veteran CTW heat-treat man hoists 72" broach from a vertical furnace.

Care in the creation of Continental Broaches takes precision manufacturing a step beyond the exactness of quality control. Thirty years of broachmaking—designing and producing thousands of standard and custom-made broaches—assures *unmatched* efficiency and performance from CTW Broaches.

Find out how Continental's experience in broach engineering, modern heat treat methods and cost-saving production processes can cut downtime and increase output in your operation. Call your local Ex-Cell-O representative, or contact Ex-Cell-O Detroit; in Canada, Colonial Tool Co., Ltd., Windsor.

59-14

Continental CTW TOOL WORKS

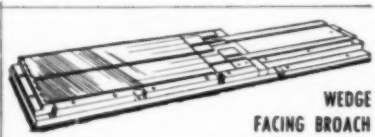
DIVISION OF

EX-CELL-O CORPORATION

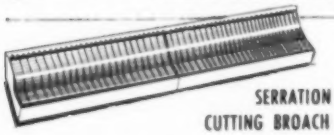
DETROIT 32, MICHIGAN

PINETREE FORM BROACH

SPIRAL SPLINE BROACH

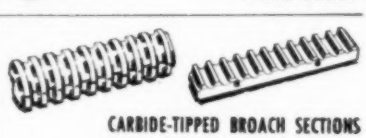


WEDGE FACING BROACH



SERRATION CUTTING BROACH

INVOLUTE SPLINE SHELL-TYPE BROACH



CARBIDE-TIPPED BROACH SECTIONS

CIRCLE 227 READER SERVICE CARD

WASHINGTON...

Steel settlement . . .

Labor leaders have been sweating out the Steelworkers' bargaining fight with the big steel makers. The Auto Workers' Walter Reuther, the Electrical Workers' James Carey and others figure the decision in steel will decide their own bargaining success for a long time. They admit being behind the eight ball. They're on the spot in asking for high wage increases even while production is booming upward along with industry profits.

Reuther concedes this. "They (management) have gotten away with this concept that automatically higher wages mean higher prices." Trouble started with Reuther's Auto Workers' settlement last year, a bad one for the union even after working three months without a contract. And then his members got 7¢. The steel industry could be much tougher.

The steel outcome will hit down the line, more than ever the pace setter. Negotiations in copper, railroads, rubber hinge on it.

Equipment imports okayed...

The administration has taken a stand against shutting off imports of foreign machinery and equipment with its latest ruling. The Office of Civil and Defense Mobilization turned down General Electric, Westinghouse Electric and other makers of heavy electrical equipment who want protection against imports of hydraulic turbines and generators from Swiss, Italian and English producers.

The companies were refused what the domestic oil producers got: a finding that imports, by reducing domestic production, are harmful to an industry which is essential to U S security.

One of the arguments GE and the others used was that foreign equipment is inferior, and that suppliers do not have repair facilities capable of servicing the equipment quickly when needed to get power back on the line.

OCDM Chief Hoegh—speaking for the White House—rejected all this, while agreeing that U S makers of the equipment are an essential to the security of the country.

Still to come: A ruling for or against putting restrictions on imports of steam turbines and generators, cobalt, fluorspar, and tungsten.

A previous ruling under the "Buy American" Law gave a government contract to Baldwin-Lima-Hamilton even though its bid was 18% higher than the low foreign bid. Reason cited: to keep elephant tools from being dismantled.

New blow on renegotiation . . .

Defense producers' pleas for liberalization of the controversial Renegotiation Act have gotten another turndown. The House voted against exemptions for incentive-type contracts and guaranteed rates of profit on defense contracts. It voted to renew the law four years, approved mild amendments to ease contractors: rights to appeal determination of "excessive" profit.

Then the Senate Finance Committee, in voting to extend the Act (for 30 months), knocked out the amendments to require the Board to spell out precisely how excessive profits are calculated in individual cases and to allow for appeals from Tax Court decisions on Board rulings.

"Munitions Lobby" talk...

The Senate committee's action reflects a new pattern of Washington hostility toward defense contractors. This general antagonism has shaped up against the background of President Eisenhower's reference to a "Munitions Lobby" trying to sway military policy and to GAO's flow of reports of over-charges on defense contracts.

On the same tack, a House committee is starting a probe into employment of retired high-ranking military brass by large defense contractors—an angle of the "Munitions Lobby" chatter into which Congress can sink its hooks the easiest.

The upshot of all this will be a resurgence of Congressional efforts to trim military contract profits, and tighter policing by the Pentagon of all the rules governing contractor operations.

Nike-Bomarc rumpus...

Despite the Pentagon's much-vaunted "Master Plan" for air defense, aimed to resolve the bitter Army-Air Force feud over anti-aircraft missiles, the production outlook for the Army Nike Hercules and Air Force Bomarc is still cloudy.

The administration proposes to continue production of both missiles, but at sharply reduced rates. Latest plans call for a scaling down of production for the two weapons by some $1.5 billion over the next five years. This is reportedly a reduction of roughly 25% in scheduled spending for production and base construction.

The Bomarc (Boeing, Westinghouse, Marquardt) cut will amount to some $900 million from scheduled spending; for Nike Hercules (Western Electric, Douglas), the reduction is estimated at roughly $600 million.

Congress may force even sharper cuts for either or both of the two missiles.

BULLARD

"H.B.M., Model 75 is better than any other machine we've ever seen."

This statement by Mr. John Gruber, Plant Foreman of George Hantscho and Company, Inc., Mount Vernon, New York, manufacturers of printing equipment, sums up their experience since installing the Bullard 4" H.B.M., Model 75, in June 1957.

He further states "our presses and paperfolding machines are made to order and each job varies from the one before it. Because of this, we can't use assembly line or mass production techniques."

"The only mass production we have is the machining of holes in cast iron, up to as many as 105 in a side frame. Since we've been using our Bullard H.B.M., Model 75, with BULLARD AUTOMATIC POSITIONING we have not spoiled a single piece due to the malfunctioning of the machine."

Do you know the full story on the Bullard H.B.M., Model 75? If not, it will pay you to call your nearest Bullard Sales Engineer — he'll be glad to give you all the details or write

THE BULLARD COMPANY BRIDGEPORT 9, CONN.

DETROIT...

73% faster...

Ward's reports that 1959's 3-millionth passenger car came off the lines on June 15, a pace 73% or four months ahead of last year, and fourth, historically, behind 1955. The statistical publication added that June 24 saw the 600,000th truck completion of the year. June volume of commercial vehicles will be the greatest since May 1955.

Rambler and Studebaker continue to lead the industry from a percentage gain standpoint with May increases of 127% and 213%, respectively, over comparable 1958. **The 300,000th Rambler of** the model year came off the Kenosha, Wisconsin, lines on June 11. The company's employment in that state is double that of a year ago, with workers being constantly recruited from surrounding farm areas.

Ford has upped its June production schedule 4%, making the tenth consecutive increase since 1959 models went on sale. **The 50,000th four-passenger** Thunderbird of the model year was produced on June 11. This is within 3000 of the three-year total of the previous two-passenger version. Order backlog now stands at 7000 units.

Chevrolet produced its millionth 1959 unit on June 15, a pace only nine days behind record breaking 1955. Breakdown as of the milestone date was 806,000 passenger cars and 194,000 trucks. Chrysler reports its first-10-days-of-June sales up 94% over the same period last year.

Dodge's New Dart...

Dodge General Manager M C Patterson chose a routine Syracuse, NY, dealer meeting to announce his invasion of the low-priced field for 1960 and thereafter. Weapon will be a Plymouth-dimensioned and priced unit called the Dart. Dodge dealers, who normally sell 23% of Plymouth's volume, will drop that franchise.

Dodge officials estimate that the Dart and the small Valiant, which will also be Dodge-made, will between them add 1650 units a day to the division's production total, at least during peak months. Darts, like bigger Dodges, will be assembled at Hamtramck, Mich, Newark, Del, and Los Angeles. Current plans restrict Valiant assembly to the Michigan site.

Observers in Detroit view the Dodge move as a daring effort to recapture volume lost to accessory laden, top-line Fords, Chevrolets and Plymouths. The Dart should sell to customers who would normally come into the showroom for a Plymouth, and Plymouth in turn expects to recoup its loss by extracting greater effort from its remaining dealers.

The Dart itself will be available in three series called Seneca, Pioneer and Phoenix in ascending order of luxury. It will offer Chrysler Corp's newly designed, overhead valve six-cylinder engine, along with a V-8 power option. Like the forthcoming parent lines, bodies will be of unit construction.

The accessory market...

Complicated auto accessories (such as automatic transmissions and air-conditioners) are an obvious but little-thought-of stimulant to the metalworking industry. Pontiac recently polled the popularity of some of the items it offers:

Hydra-Matic transmission	98%
Heater and defroster	98%
Back-up lamps	92%
Radio	91%
White-wall tires	81%
Power steering	72%
Power brakes	67%

These percentages rise and fall, depending upon the basic price category of the car involved, but accessories seem to pay off at trade-in time even in the low-priced field. Ford Division compiled these statistics on a typical 1956 model used Ford to support this theory:

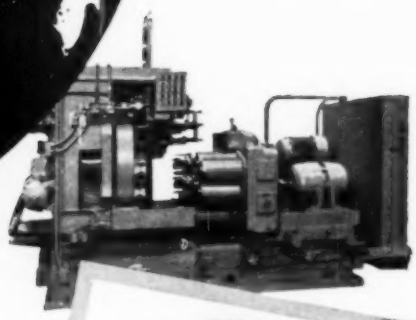
	Cost 3 years ago	Added value today	Net cost
Fordomatic	$178	$100	$78
Overdrive	110	45	55
Power steering	69	40	29
Power brakes	38	25	13
Power seat	60	30	30
V-engine (as opposed to 6 cyl)	101	100	1
Air conditioning (less heater cost)	325	220	105

Thus an owner can enjoy V-8 power and safety for three years at almost no cost, and ride meanwhile in cool comfort for very little premium. Some items, such as a heater and radio, have become so customary that few used car buyers consider an automobile complete without them.

The trend has always been that the extras of today become the standards of tomorrow. The typical used car buyer, too, is younger and less conservative. He will accept the "stripped" model only at a rock bottom, bargain price. Such a car is often-times not even readily saleable at any reasonable price, as rental agencies and other fleet owners have found out.

◄ CIRCLE 228 READER SERVICE CARD

...an example of Automatic Production by Greenlee...



700 malleable iron pipe fittings an hour...

The Greenlee 5 station, horizontal, automatic indexing machine shown above was designed and built for high-production machining of malleable iron pipe fittings. The pipe fittings are loaded, four at a time, indexed and machined at the rate of 576 to 712 pieces an hour, depending on size. The machine accommodates five different sizes of fittings.

STATION 1 — automatic load
STATION 2 — bore and rough counter-bore
STATION 3 — finish counter-bore and chamfer
STATION 4 — tap
STATION 5 — automatic unload

Let a Greenlee representative show you the modern Greenlee approach to automatic production.

MACHINES DESIGNED . . .
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TRANSFER MACHINES

GREENLEE STANDARD AND SPECIAL MACHINE TOOLS

- Multiple-Spindle Drilling and Tapping Machines
- Six and Four-Spindle Automatic Bar Machines
- Hydro-Borer Precision Boring Units
- Die Casting Machines
- Trim Presses

GREENLEE BROS. & CO.

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ROCKFORD, ILLINOIS

AIRCRAFT and MISSILES...

TRENDS

USAF clamps controls on costs...

The Air Force is tightening up on review of cost estimates and price proposals made by contractors. Over 200 auditors have been added to the Air Force's payroll to make tighter verification of such figures. In addition, the Air Force will be taking a closer look at price negotiations between its prime contractors and their subcontractors.

The new controls were spurred by General Accounting Office reports to Congress that "deficiencies" in Air Force contracting have resulted in the "negotiation of unreasonably high prices." GAO cited 14 individual cases with total "over-charges" of $30 million, recommended that the Air Force clamp new controls over contractors' cost estimates, blamed the Air Force for an "inadequate analysis" of figures.

Aircraft and missile contractors make up the bulk of companies in GAO's report on contract over-pricing: McDonnell Aircraft, Boeing Airplane, Lockheed Aircraft, GM's AC Sparkplug Division, General Precision Laboratory, Cessna Aircraft, Rheem Manufacturing, Friden, Avco's Crosley Division, Menasco Manufacturing, Avtron Manufacturing, Firestone Tire & Rubber, Goodyear Aircraft, and Lambert Engineering.

The Air Force has recovered refunds from some of the contractors on cases cited by GAO. But a case involving McDonnell has been referred to the Justice Dept for action, the Air Force has told a House Committee. The case presumably involves allegedly excessive subcontract costs on the F-101 project.

The Air Force has brought its contract payment policy in line with Army and Navy regulations, will now allow contractors to earn full profit on equipment shipped to the Air Force, rather than require them to wait until a full production run has been completed.

The new policy affects progress payments on fixed-price contracts. Up to now, contractors normally have been getting only 70% of costs during the course of production. Under the new policy, they will also receive payment to cover estimated profit as deliveries are made.

$7.5 billion more for defense?

America's current defense program is a mess, according to the Democratic Advisory Council, and it is lagging badly behind Russia's, is disorganized, and lacks direction.

Not only that, the Democrats say, there's too much money being spent on countermeasures against the threat of enemy bombers, too little on defense against intercontinental ballistic missiles. What's needed, the Democrats say, are (1) more intercontinental ballistic missiles, (2) a bigger Army, (3) accelerated development of nuclear weapons, (4) more jet tankers to free the Strategic Air Command from dependence upon foreign bases, and (5) stepped-up development of long-range, nonballistic missiles.

Such a program would cost $7.5 billion a year over and above planned defense expenditures, breaking down this way: $3 billion more for the Air Force, $3 billion more for the Navy, and $1.5 billion more for the Army.

But Republican reaction to the Democrat's proposal, which was issued in pamphlet form, was immediate and angry. Said the Republicans, the proposal coming as it does at a time when the Geneva conference is at loggerheads, is "especially ill-advised, ill-conceived, ill-timed and irresponsible."

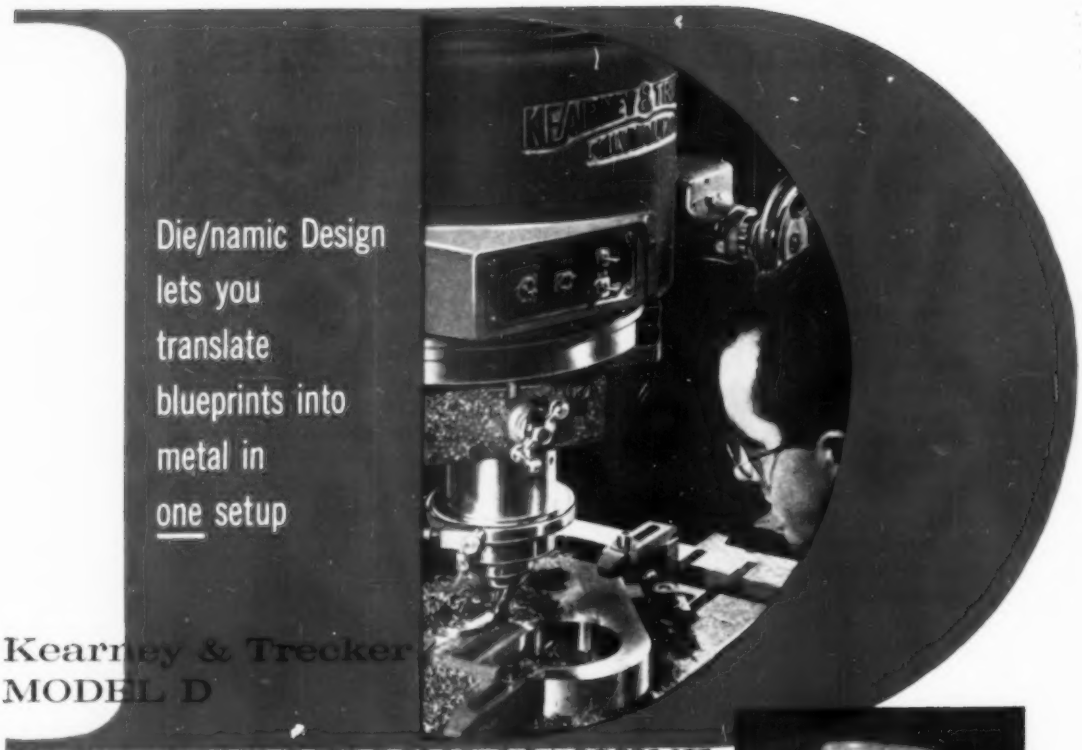
Keeping tabs on Atlas spare parts . . .

Upwards of 40,000 parts go into the making of a single Atlas missile. Not only that, a lot of those parts are subject to change because the Atlas is still in the R & D stage. Keeping track of spare parts, as one Convair Astronautics executive puts it, is "roughly comparable to what the spare parts supply problem would be for an automobile manufacturer who turned out a new model every month instead of every year."

But now the job has been turned over to an electronic computer system with a 10-million character "memory," designed to keep track of parts for test bases and for operational sites during the operational buildup period. After that, control will pass to the Air Force, which has a computer system capable of handling spare parts for the entire ballistic missile program.

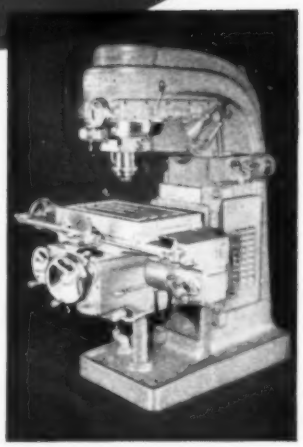
Convair Astronautics' system is built around an IBM Ramac 305 computer, can determine within seconds the complete history of a part sought by any base—providing (1) the date the part was issued, (2) its price, (3) usage history, (4) quantity on hand at various bases or in transit from base to base, and (5) rate of parts use.

Biggest advantage of the system will be to cut down on rush orders for parts, and to expedite delivery of those orders that must be rushed. In other words, if a test base needs a part immediately, the machine will diagnose the supply situation for that particular part at electronic speed—determining within seconds the location of the nearest part. When such information is desired, the operator merely "asks" the computer by punching five keys, and the printed answer comes out within a few seconds.



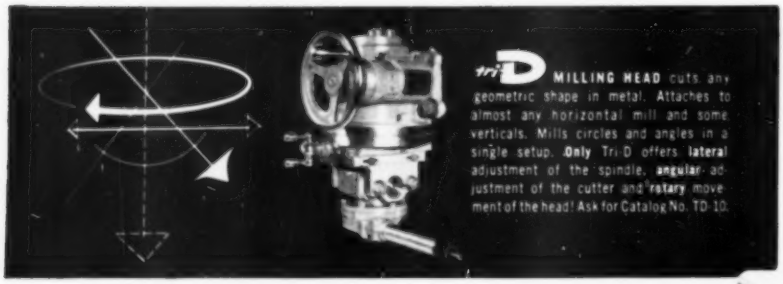
Kearney & Trecker MODEL D ROTARY HEAD MILLING MACHINE

Change job planning time into profitable production time! Simplify and speed close-tolerance milling of tools, dies, molds and parts having multiple radii — on Die/namic-designed Kearney & Trecker Model D Rotary Head Mill. It ideally combines precise mechanical control of spindle offset and rotary head motion, so that straight, angular and radial movements can be effected — all in a single setup. In production work, Model D eliminates jigs, fixtures, models and templates. For facts, see your nearest Kearney & Trecker representative or write direct.



AVAILABLE ON TOOL LEASE

Conserve capital, reduce machine obsolescence — check into K&T's Tool Lease Program. Choose the machine you need from nearly 350 different standard milling and precision boring machines.



TriD MILLING HEAD cuts any geometric shape in metal. Attaches to almost any horizontal mill and some verticals. Mills circles and angles in a single setup. **Only** TriD offers **lateral** adjustment of the spindle, **angular** adjustment of the cutter and **rotary** movement of the head! Ask for Catalog No. TD-10.

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KEARNEY & TRECKER MILWAUKEE

MACHINE TOOLS...

Detroit senses big year ahead...

Detroit is feeling more bullish than at any time since 1955. Not only has car demand turned up more sharply than anticipated, but also automotive people sense a pretty big year in 1960.

Passenger car production this year is sure to be 5.6 million units, with a strong possibility that it may rise to 6 million. If the latter figure is attained, car and truck output in 1959 would hit 7 million units. For 1960, predictions are for an increase of 1 million units over this year.

While no major tooling programs loom in the auto industry, machine tool orders out of Detroit promise to be better in the months ahead than for the past two years. But there will not be "splurgy" buying of the kind that filled up builders' plants a few years back.

Surplus machine tools, of which there were quite a lot, are being used up in one way or another by auto makers. Example: Rebuilding of big transfer machines and of other high-production machines is having the effect in certain cases of reducing considerably the production capacity for making engines. Two mammoth transfer lines are cannibalized to secure one rebuilt line.

Six Soviet machines to be shown . . .

Six machine tools plus two automatic size classifiers are to be shown in operation at the USSR Exhibition opening at the New York Coliseum June 30.

Two Soviet-designed and built tape-programmed vertical millers will do die sinking and other 3-D operations, being controlled from moderately small consoles equipped with magnetic-tape handling mechanisms. Tapes are programmed separately ahead of time and then are run through the consoles to direct table feed, table traverse and spindle motions.

An automated helical bevel gear cutter will turn out gears with about a 3½-in. OD in 4-minute cycles, feeding blanks from a chain loader and ejecting them when finished into a pan. A medium-size copying lathe for small shafts has automatic size control. This machine loads and unloads mechanically.

Russian catalog available . . .

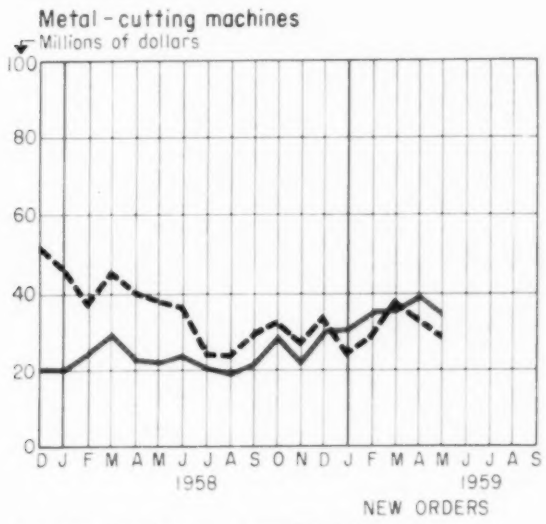
Stankoimport, Russian selling agency, has available a 109-page catalog in English of Soviet products being offered for export, including most types of both metal-cutting and metal-forming machines, cutting tools and abrasives, woodworking machines, portable electric and pneumatic tools, ball and roller bearings, measuring instruments, cameras and motion-picture equipment.

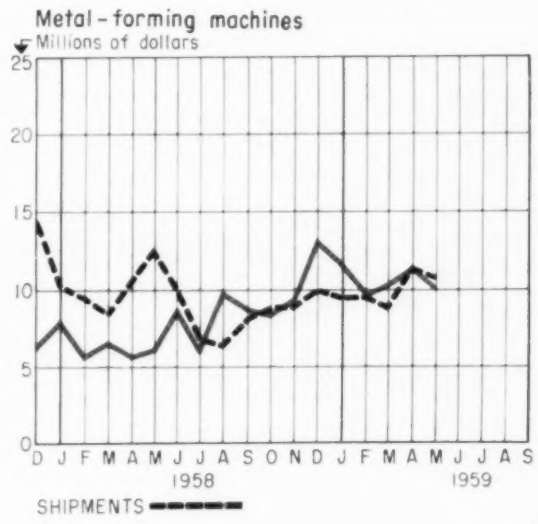
Automatic transfer machines and "automatic workshops" are among the products sold for export.

Norton buys Gould & Eberhardt . . .

Norton Co, Worcester, Mass, has acquired the inventories, machinery and equipment, with drawings, designs and certain other assets of Gould & Eberhardt Inc, Irvington, N.J. The assets are to be moved to Worcester where the G&E line of shapers and gear hobbing machines will be made in Norton's Machine Tool Division. Sales of Gould & Eberhardt machines will be continued through their present distributors.

Gould & Eberhardt, which was founded in 1833, has been building shapers for more than 100 years and started manufacture of gear-cutting machines in 1877.





Questions and Answers on METALWORKING MACHINERY

...for those concerned with specifying or buying new equipment

QUESTION: Who is the largest national supplier of metalworking machinery equipment?

ANSWER: Ryerson is the largest by far – offering over 3800 different types and models produced by almost 100 of the nation's leading manufacturers.

QUESTION: What types of machinery does Ryerson offer?

ANSWER: The most complete line available anywhere, including the best type and right capacity for every metal-fabricating job of:

Bending	Forming	Punching	Shearing
Braking	Hoisting	Rolling	Threading
Drilling	Pressing	Sawing	Welding

QUESTION: What advantages do I get by buying from Ryerson?

ANSWER: (1) Widest selection, (2) Unbiased recommendations, (3) Double guarantee: the manufacturer's warranty backed by Ryerson assurance of satisfaction, (4) Greater continuing interest because we also value your steel and aluminum buying potential, (5) A nation-wide organization of machinery specialists backed by 117 years of Ryerson experience in working with metal fabricators and in using much of the equipment in its own steel service operations.

MACHINERY DIVISION

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TRENDS

MATERIALS...

Relay developments move fast...

For some time the need for better, more reliable, less costly control relays has been recognized. Generally, the demand has not been for extremely long life, for machine control, but for a shorter, more dependable life at a lower cost. Relay manufacturers have been concentrating on this problem. Before the end of this year, a number of telephone-type electro-mechanical relays, offering 50,000 to 100,000 cycles, at up to 300 volts, should be on the market at a price below $10 apiece. Meanwhile, a power-handling relay which operates on an entirely new principle will be announced very soon.

Sub-miniature motor...

Less than 1 inch in diameter and only $1\frac{3}{8}$ in. long, a subminiature motor developed by A W Haydon Division of Consolidated Electronics Industries Corp for use inside Vanguard II is available for industrial use. Operating on only one-tenth of a watt, the motors were installed to drive a miniature tape recorder. Seven motors require the same power as a two-cell flashlight bulb. The motors run at 2500 rpm; each of them has a permanent magnet within the rotating coils, and is fitted with ball bearings. In addition to original equipment installations, it is expected that the motors will be useful actuators in controls and instrumentation.

Plastics in automobiles...

"Where can some of the new materials, the newer plastics, and plastic-working techniques be used to advantage in tomorrow's automobiles?" This was the question Montgomery Ferar, of Sundberg-Ferar Inc, Detroit industrial designers, told a group of automotive and plastics engineers that he is asking himself as he drives around in his car. Mr Ferar used industrial experience, to date, with boats, plumbing and appliances as a base. To this he added the variables of mobility and high capital investment in high-production metalworking equipment. Here are ideas he believes will get early attention:

- **Intricately contoured instrument panels** have been built by using preformed sheet plastic backed up by plastic foam. Why can't car seats be made in the same manner?

- **Possibly, foamed insulation** should also be applied to door interiors. In fact, the entire door could be molded as a single unit, with bearings for handles, ventilation ducts and window-regulator housings included. Foam would improve sound dampening, provide better insulation to retain heat in the winter, and improve air-conditioning efficiency in the summer.

- **Non-dentable plastic fenders** are being tested for taxicabs. With proper automatic manufacturing they might prove feasible for private vehicles. Possibly the ultimate in fenders would consist of plastic wedded to another material.

- **Plastics combined with other materials** could replace metal for door handles, grilles and other hardware. Metallized plastics offer a variety of advantages over polished metal for bright work. Similarly, a plastic laminate with another material could be used for floorboards to combine corrosion resistance on the underside with a permanently carpeted upper surface that would resist stains, wear and abuse.

- **A definite ceiling on the amount of plastic,** in substantial poundage, will exist as long as we are confined to molding techniques as we know them today. More automatic processes, capable of rapidly producing major components as complete units are essential to overcome present methods and materials.

Chrome-treated clutch sprags...

A completely new line of higher performance clutch sprags is announced by Formsprag Co in cooperation with Chromalloy Corp. The new sprags are now chromallized—resulting, says J Lawrence Buell, Jr, president of Formsprag, in higher performing over-running clutches on many more applications than was ever dreamed possible before. It is considered a major breakthrough in clutch performance. The new clutches are available at no increase in cost.

Chromallizing is a trade name for diffusion alloying, or thermal chromizing as it is sometimes called. The process consists of packing parts, together with a chromium-containing powder, into a sealed retort and exposing retort, in a furnace, to a time and temperature cycle similar to pack carburizing. The result, in this instance, is a sprag having a surface hardness of R_c 80 (1900 Vickers) and an annealed steel core. Heat treating this sprag hardens the core to R_c 61-63.

Ductile iron for valves...

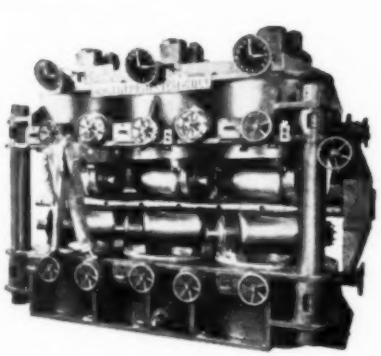
Use of ductile iron for valve bodies has jumped, according to International Nickel Co, Inc, from 6,000 tons in 1958 to 20,000 tons for 1959. By 1961 the use of ductile iron by the valve industry is expected to climb to 100,000 tons—16 times in about four years.

...ALL SIZES STRAIGHTENED AND PERFECTLY ROUNDED ON MACK-HEMP ROTARY TUBE STRAIGHTENERS

Tubes of any alloy in any O.D. from .050-inch to 16 inches are production straightened and rounded at speeds up to 800 feet per minute or better. The six driven rolls are fully adjustable to suit tube diameter, amount of straightening bend needed, and correct contact grip on the tube. The machine operates without speed-limiting, surface-marring guides and the finished tubing shows no spiral markings.

All models – from the smallest to the largest – are now available in Mack-Hemp's exclusive new three-post construction.

For complete details of Mack-Hemp straighteners, write today for a free copy of our 24-page Technical Bulletin No. 55-A, "How to Straighten Pipe and Tube".



MACKINTOSH-HEMPHILL Division of E. W. BLISS Company

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Makers of the rolls with the Striped Red Wabblers

WHAT'S AHEAD... in Metalworking

TRENDS

Metalworking production back to peacetime peaks...

U S metalworking output is now within a point or two of the peacetime record highs it reached in boom 1956. But even more significant is the fact that this time the climb has been steadily upward for a full year, whereas 1956's rise was an abrupt one of about six months' duration.

This time, metalworking production could climb well beyond the 1956 record—unless a prolonged steel strike upsets the metalworking applecart. But even so, Midwestern steel producers and warehousers now estimate there is enough steel on hand to carry industry through everything but a really long-drawn-out strike.

Such shortages as do show up will probably be in flat-rolled products, which have been in such heavy demand recently that inventory accumulation has been difficult.

The Midwest area would be most affected by shortages. Sales of steel sheet in this area have been running 80% ahead of comparable 1958, and warehouse stocks are at three months.

Plates and structurals are in about six months' supply nationally, hot-rolled bars and cold-finished products at five months. Galvanized sheet, tight for months, is at a two months' supply level, could get into a bind very quickly.

Stamping industry would be among the first to feel the effects of a prolonged steel strike, simply because the highly diversified nature of stamping work keep shops from stockpiling much raw material against new orders.

But stamping shops, meanwhile, are running something like 80% ahead of 1958 levels, and shipments are about 20% higher.

This same uptrend is now reflected in almost all basic metalworking industries, which are following the recovery lead of such producers of consumer goods as automotive, appliance and farm equipment manufacturers.

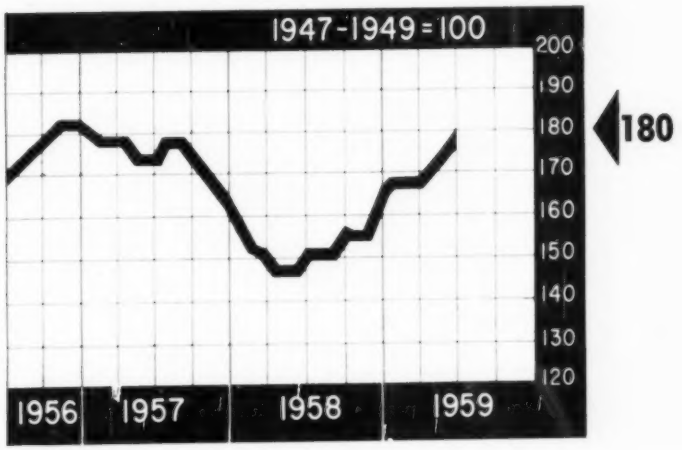
Take for example, heat treating shops, which reflect higher production in the farm equipment, automotive and other industries—business is now up anywhere from 25 to 50% over comparable 1958 levels. Part of this increase is attributable to the steel strike threat, but the fact remains that most shops, as one owner puts it, "are so loaded they could live off the pantry."

Screw machine products manufacturers, one of the first industries to suffer from the recession, now report that orders are pouring in from many sources, notably roadbuilding equipment makers, automotive and appliance companies. Business is currently running at least 30% ahead of last year.

Mill supply houses, a good bellwether of metalworking conditions, say current cutting tool business is anywhere from 26 to 31% ahead of last year, precision tools are up about 21%, and high-priced fasteners are moving well.

Sales of industrial heating equipment, despite this business's seasonal fluctuations, have been increasing steadily for the last six months, and the outlook for the rest of the year is bright.

Conveyor manufacturers, too, report a decided upswing in new orders and production since the first of the year, and quoting is heavy on major capital improvement jobs.



AMERICAN MACHINIST INDEX OF METALWORKING PRODUCTION

BASED ON MANHOURS WORKED IN THE FIVE COMPONENTS

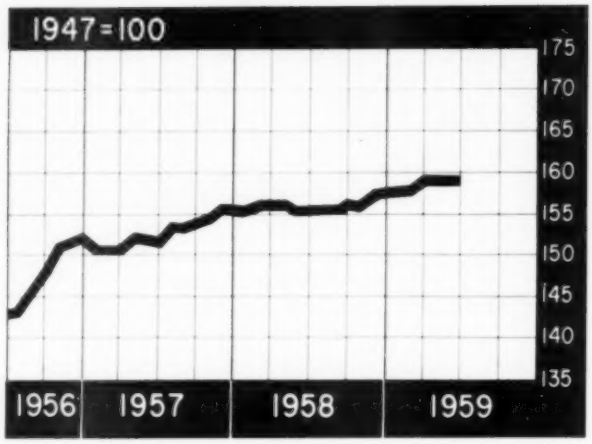
	JUNE Estimated	MAY Preliminary	APR Revised	MAY Year Ago
Total Index	**180**	**178**	**173**	**148**
Machinery	148	145	123	
Electrical Machinery	207	198	167	
Autos	132	133	90	
Other Transportation	363	348	340	
Other Metalworking	154	149	126	

TRENDS

WHAT'S AHEAD... in Business

AMERICAN MACHINIST INDEX OF METALWORKING PRICES

	JUNE Estimated	MAY Preliminary	APR Revised	MAY Year Ago
Total Index	**158.6**	**158.6**	**158.5**	**155.8**
Metalworking Machinery	... 184.9	184.2	181.1	
Other Machinery exc. Electrical	. 169.6	169.6	165.8	
Electrical Machinery	.... 159.7	159.3	158.5	
Fabricated Metal Products	..... 148.8	148.8	146.4	



Industrial output still growing...

Production continues to grow as we approach the steel contract deadlines. The Index of Industrial Production for April was revised upward to 150, and during May the Index climbed to 152—far above the recession level of a year ago. **Growing production** has meant a steady increase in the number of jobs available. Unemployment fell by a quarter-of-a-million last month—the third straight drop recorded this year. Total unemployment is now down to 3.3 million—less than 5% of the labor force, and the lowest it's been in over a year. So it's pretty clear that even the lingering effects of the recession are gradually disappearing.

Business inventories (swelled by a buildup of steel stocks) grew at an annual rate of $6 billion for the first quarter of the year, and will probably hit a rate of $8.5 billion for the second quarter.

That second quarter rate will thus be the highest level of inventory buildup reached since 1951, and is definitely higher than that required to handle current sales levels.

A fall in the rate of inventory accumulation is therefore, likely to come in the second half of the year, but it won't signal the beginning of a slump. A fall in the demand for steel is a pretty sure bet, but it won't come as a surprise. And there is likely to be a slowdown in building of auto inventories.

But consumer borrowing for new car purchases has been growing steadily, and that's a good indication that dealers won't be stuck with current stocks.

Capital spending, on the other hand, will continue to provide a healthy boost to the economy. The Department of Commerce, which conducts a quarterly survey of capital spending plans, recently reported that businessmen have revised their capital spending plans upward from the levels reported three months ago. This should hold through the second half.

WEEKLY BUSINESS INDICATORS

	Latest Week	Preceding Week	Year Ago
Business Week Index of Activity (1947-1949=100)*	155.8	155.0	133.3
Steel ingot operation (thousands of tons)	2,631	2,604	1,751
Electric power output (million Kilowatt hours)	13,503	12,761	11,681
Production of automobiles and trucks	165,090	162,200	105,566
Engineering construction awards (Eng. News-Record—millions)	$546.1	$522.7	$429.9

MONTHLY BUSINESS INDICATORS

	Latest Month	Preceding Month	Year Ago
Index of industrial production (1947-1949=100)*	152	150	128
Index of durable manufactures production (1947-1949=100)*	168	164	134
Durable goods manufacturers sales, millions*	$15,123	$14,376	$11,532
Machinery manufacturers' sales, millions*	$ 4,400	$ 4,226	$ 3,748
Durable goods manufacturers' new orders, millions	$15,582	$15,308	$10,833
Machinery manufacturers' new orders, millions	$ 4,585	$ 4,839	$ 3,596

* Seasonally adjusted

59-28

IT'S 'TUNE-UP' TIME FOR PRODUCTION MACHINES!

How long has it been since you "raised the hood" of your Ex-Cell-O production machines? Even the most reliable equipment will run faster, more accurately and *longer* after a thorough going-over by skilled Ex-Cell-O machine repairmen.

Ex-Cell-O machines returned for renewal, repair or modernization are carefully inspected, disassembled and reworked from base to bridge, with new machine accuracies. The products of preferential treatment, they move right alongside the newest Ex-Cell-O machines, rejuvenated by the familiar touch of the men who know your Ex-Cell-O machines best—the men who build them.

Necessary replacement parts are Ex-Cell-O "original equipment" quality; rewiring or re-worked controls conform to JIC standards; tables and ways are hand-scraped to their level-best; coolant and lubricant systems are restored to full efficiency, spindles are trued, and tooling can easily be up-dated to your specifications.

Call your local Ex-Cell-O Representative, or write direct for details on how your older Ex-Cell-O machines can be economically "tuned" to today's production demands.

EX-CELL-O FOR PRECISION XLO

EX-CELL-O CORPORATION *Machinery Division*

DETROIT 32, MICHIGAN

Ex-Cell-O Precision Products Include: Machine Tools • Grinding and Boring Spindles • Cutting Tools • Railroad Pins and Bushings • Drill Jig Bushings • Torque Actuators • Thread and Groove Gages • Granite Surface Plates • Aircraft and Miscellaneous Production Parts • Dairy Equipment

CIRCLE 233 READER SERVICE CARD

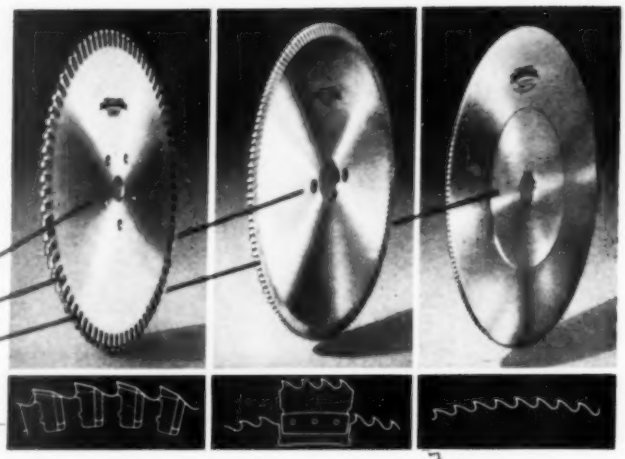
Do you cut ferrous metals? If so, Simonds has three basic saw designs for you:

INSERTED TOOTH METAL SAWS

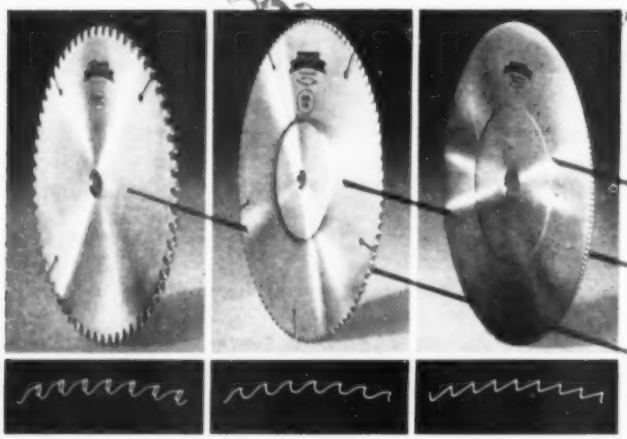
SEGMENTAL SAWS

SOLID TYPE SAWS

Available in High Speed and Semi-High Speed Steels



There's a SIMONDS Circular Saw Exactly Right for Your Metal Cutting Job



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for cutting aluminum and magnesium, as well as other non-ferrous metals

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Factory Branches in Boston, Chicago, Meridian, Miss., Shreveport, La., San Francisco and Portland, Ore., Canadian Factory in Montreal, Que., Simonds Divisions: Simonds Steel Mill, Lockport, N. Y., Heller Tool Co., Newcomerstown, Ohio, Simonds Abrasive Co., Phila., Pa., and Arvida, Que.

American Machinist
MAGAZINE OF METALWORKING PRODUCTION • ESTABLISHED 1877

Where You Go From Here

Are you in a flap over foreign competition? Are you lying awake nights worrying about that British or German firm taking that big order right out from under your nose?

If you are, Washington's latest decision will put you further into a tizzy. The government does not intend to do anything to curb or end the practice whereby foreign builders of turbines and generators are selling to U S customers at prices far less than domestic manufacturers. The same policy, with White House backing, will hold in other products.

What Washington is saying is simply this: "Boys, you are on your own. You will have to shift for yourselves in domestic and world markets."

Well, at least you know where you stand. After the jitters have passed and you have recovered your equilibrium and usual American resourcefulness, the question is: "Where do you go from here?"

There is no clear-cut answer...

You might well hide behind that vague, unsatisfactory phrase, "it all depends." And you would be correct in doing that if you enlarged the phrase to "It all depends on you."

To dispose of the world market problem first, several choices are open. One is to try to compete right from your home plant. You run the risk, if the price and quality of your product is not right, of finding yourself in a dwindling if not a vanishing market abroad.

In case you are the kind that wants to get all the world market that you can, you establish a plant or plants of your own abroad, or you license a foreign company to make your product. One or the other of these plans has been successfully carried out by thousands of American manufacturers.

So much for the global aspect. Suppose we come back home. What should you do to compete profitably here? First of all, you should make sure that your product is of today's design and not yesterday's. There was a time, not long ago, when too many companies were satisfied to jog along for years without any major product redesign or without introducing any new products. Foreigners put an end to this when they took business away at lower prices. If U S companies had been even half alert, the story would have been different.

Keep in mind this point...

Our national pride may be a bit bruised by the admission, but the fact is that not every American product is the best in the world. We don't have a complete monopoly on talent and the ability to put it to good use. Some foreign goods are going to be sold here by somebody.

Now we get down to the heart of the matter. Roger M Blough, U S Steel chairman, states the problem bluntly. To compete successfully against foreign firms, we must "improve constantly our productive efficiency and thereby reduce our costs." Our ability to do this will depend upon "our capacity as a nation to acquire and pay for new, more efficient tools of production."

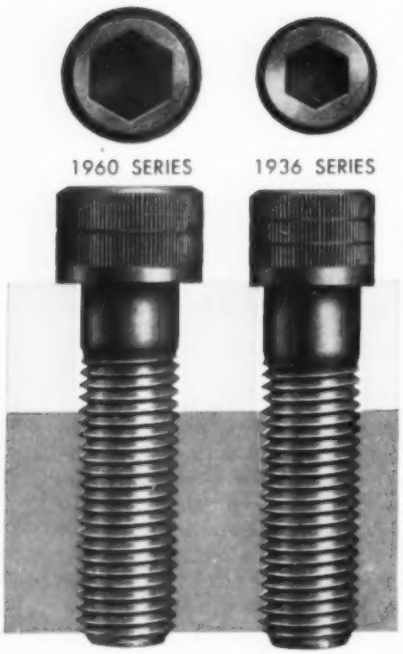
More than that...

management and labor must join in holding down costs and in increasing productivity to try to end the wage-price spiral. Labor has equal responsibility with management in this particular respect.

Americans must drop their complacency and get to work. Competition from other countries has been light until recently. Now that it is more severe, and in some industries is critical, there is no reason to be panicky. Best way to combat it is by using to the limit that American resourcefulness and courage that have made us the world's shining example of economic abundance.

Burnham Finney EDITOR

Allen's *New '60 Series* Socket Head Cap Screws



give up to 2⅓ times more load carrying capacity ...without indentation!

In Allen's new '60 Series, head diameter of sizes from ¼" up is now uniformly one and one-half times the body diameter. In many sizes (where this ratio was not called for by 1936 Series specifications) this will provide *more* under-the-head bearing surface, and a proportionate *increase* in clamping force. Loads are more evenly distributed, and the greater bearing area in many cases eliminates need for washers.

Socket sizes have been increased in many cases—greater wrenching area permits higher tightening torque—which resists fatigue failure, and lengthens the life of the threaded joint.

- A new 2-band knurl will identify all ALLEN Cap Screws (except Stainless Steel) that conform to the new '60 Series specifications. New labels on boxes will also identify these.
- The 1936 Series of Allen Cap Screws will continue to be available.

COMPARISON OF ALLEN 1960 SERIES AND 1936 SERIES SOCKET HEAD CAP SCREWS

SCREW SIZE	HEAD DIAMETER Minimum (inches)		BEARING SURFACE Minimum (square inches)		PERCENT OF INCREASE IN BEARING SURFACE[1]	TENSILE LOAD TO INDENT IN SOFT STEEL[2] (lbs.)		TORQUE INDUCED TENSILE LOAD TO INDENT IN SOFT STEEL[2] (lbs.)	
	1960 Series	1936 Series	1960 Series	1936 Series		1960 Series	1936 Series	1960 Series	1936 Series
¼	.365	.367	.044	.044	—	4,750	4,750	2,780	2,780
5/16	.457	.429	.070	.052	33	7,440	5,600	4,380	3,300
⅜	.550	.553	.111	.111	—	12,100	12,100	7,000	7,000
7/16	.642	.615	.140	.103	36	15,000	11,000	8,850	6,450
½	.735	.739	.183	.183	—	19,500	19,500	11,500	11,500
9/16	.921	.863	.293	.216	35	31,000	23,200	18,500	13,600
⅝	1.107	.987	.424	.224	89	45,000	24,000	26,700	14,100
⅞	1.293	1.111	.585	.253	131	62,500	27,000	36,800	15,900
1	1.479	1.297	.768	.405	89	82,000	43,500	48,500	25,500

[1]Head tolerance revisions on Sizes #0 thru #10, ¼, ⅜, and ½ diameter have no significant effect on bearing surface or holding power of screws.

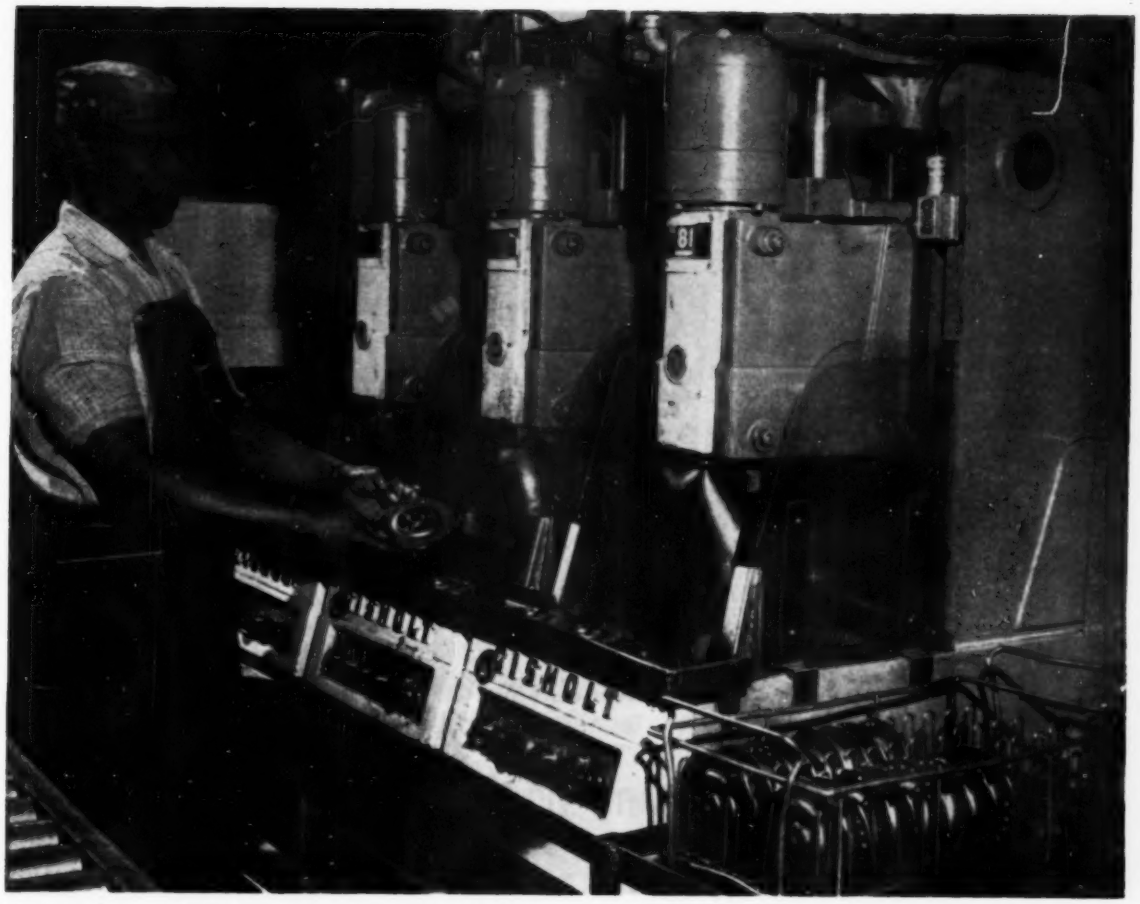
[2]Values based on .00025 inch indentation.

Ask your Industrial Distributor about ALLEN '60 Series Cap Screws. Write for samples and complete specifications. Ask for Bulletin G-25.

ALLEN MANUFACTURING COMPANY
Hartford 1, Connecticut, U.S.A.

Stocked and sold by leading industrial distributors everywhere

ALLEN HEX-SOCKET SCREWS HEAD



Honing after spotfacing produces flatness within 0.000,005 in. on water-pump impellor hubs. The CI impellors are honed with a 280-grit stone and a water-soluble coolant. Spindle speed is around 1000 rpm; stone pressure about 15 lb

Flatness within millionth... ... in production

When Buick says "flat" for water-pump impellors, Buick really means flat—within five millionths. To make sure, the company applies one of the few production-line inspection setups with monochromatic light and optical flats. The results, even though only 3% of production is checked, are the most accurate flat parts in the car.

But inspection didn't do it alone. Buick Motor Div, GMC, had to add honing to the processing operations on impellors. This eliminated rejects. Of thousands of pumps made, only a few leak—because of cracked impellors, chips or dirt under the seal, or other irregularities—but none leak because of poor sealing.

Machining that precedes honing includes drilling, reaming, boring, spotfacing, and counterboring the hub square with the bore within 0.002 in. This is all done at a 6-station Kingsbury machine, where the hub face is held flat within 0.001 in. by spotfacing carbide cutters. This is a total tolerance, within which the hub face may be dished to a maximum high of 0.0005 in. at the bore and to a maximum low of 0.0005 in. at the OD. After this, the impellors are balanced within $\frac{1}{8}$ oz-in.

Automatic honing

Three No. 81 single-spindle Gisholt Superfinishing machines are grouped together for automatic honing. One operator accepts parts delivered in baskets from the balancing operation, and he loads and unloads honing stations while the others are operating. The finish produced here is acceptable at 10-20 mu in. because allowance is made for a break-in period during operation. **This flatness is honed in 15 seconds** machine time.

Inspection with optical flats follows honing. A Crane Lapmaster first lightly polishes the work for maximum reflectivity in light-band interpretation. The Lapmaster monochromatic light has a helium source of 40-footcandle power that produces light with a wavelength of 0.000,023,2 in. However, because only half this length is applied in measurement, the useful increment is 11.6 millionths. Dark bands on the work surface are seen through the optical flat to show

Flatness within millionths...

interference patterns reflected from two surfaces.

The distance from the center of one dark band to the center of the next indicates the length in which the surface of the work is high or low by 11.6 millionths. Correct interpretation of interference patterns is simplified by a chart illustrating several possible conditions and the values to be applied in each case.

This care in making the impellor faces flat pays off. Although pressure in the car cooling system usually runs 14-15 psi, sealing action of the rotating impellor hub against a stationary rubber compound seal is checked to 25 psi.

Optical flats and monochromatic light check 3% o production. Flatness is indicated by straight bands; concave or convex surfaces by curved bands. Sample chart covers most cases

Some new electroplating and finishing ideas

Experts from a dozen countries made Detroit the scene at mid-month for the exchange of new techniques and ideas on electrodeposition and metal finishing as the American Electroplaters' Society held its 50th annual convention concurrently with the 5th Industrial Finishing Exposition. Some 2000 metal finishers and 150 exhibitors were on hand.

Top attention-getter among 45 technical papers was one describing a black-chromium-plating process that can be operated over a relatively low current-density range (150 to 450 amps per sq ft). As outlined by Dr A Kenneth Graham of Graham, Savage & Associates, the process temperature ranges from 70 to 100 F, with cathode efficiencies from about 6 to 15%.

Uniformly deep black deposits are obtained with various coating thicknesses that have wear resistance up to three times that of bright nickel. The black-chrome coating can be applied to any base metal that can be plated, thus is expected to serve as a substitute for porous or hard chromium in some cases.

Epoxy-resin coatings for the protection of plating-room equipment, for clear films over decorative finishes, and as stop-off coatings were described by Shell Chemical Corp's H W Howard. The resistance of these resins to chemical attack is so high that a stop-off coating applied before plating may be retained as part of the final finish in some instances. Other advantages: superior adhesion, flexibility.

Shot-peening before plating

From Britain's Ministry of Supply came a paper on the effects of shot peening prior to chrome plating. At the Ministry's Armament Research and Development Establishment, fatigue strengths of two steels of 180,000 and 224,000 psi tensile strength were increased progressively with the intensity of shot peening. Increased surface roughness resulting from peening at various intensities was measured for both steels, as was the effect on the fatigue limit of grinding before or after plating.

Among other papers presented during the sessions: "Vinyl Dispersions in Metal Finishing," by Myron Perez, Metals & Thermit Corp; "New Applications of Vinyls in Coatings," by W H McNight, Union Carbide Plastics Co; "Ductility in Plated Coatings," by Dr Harold J Read, Pennsylvania State University and Dr Thomas J Whalen of Ford Motor Co; "European Electrolytic Polishing Practice," by Robert Mondon, Societe Jacquet - Hispano Suiza, France; "Chemical Polishing Processes," by Dr H Spahn, Institut fur Werkstoffkunde, Germany.

Also discussed were the effects of such surface treatments as chemical milling, anodizing, acid-etching, electropolishing and other methods on fatigue resistance of high-strength aluminum alloys—by Galtan Abadie, Societe Exploitation Materiels Hispano-Suiza, and Georges Vidal of France's National Office d'Etudes et de Recherches Aeronautiques.

Exhibited at the Industrial Finishing Exposition were: buffing and polishing compounds and machines, coatings, tumbling barrels, heat exchangers, filters, pumps, rustproofing material, degreasing equipment, metal-cleaning compounds, racks, thickness gages, rectifiers, motor generators, plating machines.

Of particular interest: a 9-foot-high, all-purpose conveyor that can be used in plating, anodizing and phosphating on quickly interchangeable cycles.

Zenith and Emerson battle it out...

Printed circuits—yes or no?

Modern printed circuits work; there's no question that they do. But are they always practical, especially in consumer products that do not require military-style extreme miniaturization? This point of contention was covered at the recent IRE 3rd annual Production Techniques Conference at San Francisco; Dorman D Israel of Emerson Radio & Phonograph covering the "pro" side, Donald MacGregor, Zenith Radio, taking the "con."

Are printed circuits reliable? Pro—"wiring and shielding are securely anchored . . . with performance stabilized. Components are not as apt to be abused . . . wiring stays put." Con—"Entire sections may burn out as a result of tube or component failure . . . some boards become embrittled as they cure . . . the laminate will not tolerate heat . . . the conductor may peel . . . the foil conductor is susceptible to minute breaks."

Are they cheaper?

How about costs? Pro—". . . . in high volume, manufacturing cost is known to have been sharply reduced. A 5-tube broadcast receiver has been conservatively estimated to yield a 35% reduction of labor content . . . for TV receivers the percentage is lower, but is still substantial." Con—"Figuring costs may not be so easy. Overhead costs applied to a line must be altered if they are considered as a percentage of direct labor. Some manufacturers now claim printed circuitry is more costly, but it improves the product."

Are they tougher to service, and therefore cost the consumer more for upkeep? Pro—"It must be admitted that early designs made some vulnerable components inaccessible and that access was difficult. But insufficient field data and human resistance to change were also early growing pains." Con—"Some repairs cannot be made without special tools . . . circuitry of etched boards is especially difficult to trace . . . many servicemen charge an extra fee ($4.50 to $8.00) for working on printed circuits . . . customers must wait an unreasonable amount of time when boards must be replaced."

Is product performance better because of printed circuitry? Here the disagreement is violent: Pro—"Freedom from the idiosyncrasies of hand wiring and its co-worker, human error, brings with it a guarantee of uniformity in performance. Really mature engineering know-how must attend this advanced art. Performance is stabilized at the maximum design level . . . printed circuit naturally assures better reliability." Con—"An engineer associated with one of the country's largest research and development laboratories reports that he has never measured up an ordinary five-tube radio with printed circuits that had all the performance in it that a conventionally wired chassis has."

Where should printed circuits be applied, and why? There is some agreement here, but the two companies basically disagree on whether or not printed circuits should be applied to standard consumer products. According to Emerson—"There are five broad reasons for printed circuits: miniaturization, mechanization of processes, uniformity of performance, improvement in reliability, and reduction of cost." But according to Zenith—"Some applications are mandatory, such as eyeglass hearing aids, military and space instruments, and missiles. But the designer must know the advantages and disadvantages for a specific application."

Individual mounting patterns for five basic machine tool sizes?

It looks as though each of five basic machine tool unit sizes will have its own mounting pattern in the future. That is, if recommendations of the newly formed Machine Tool Builders Standardization Committee (AM—Jan 12, '59, p107 and Jan 26 '59 p95) are adopted by industry.

The new recommendations, made June 1, are a reversal of a tentative agreement made at a meeting of builders and users last January, in which it was decided that some machine tools of different sizes could have the same mounting patterns and dimensions. (Example: dimensions of the overall width of mounting flanges on wing bases in machine tool sizes 1 through 5 were to be 22 in. for Size 1, 33 in. for Sizes 2, 3 and 4, and 43in. for Size 5).

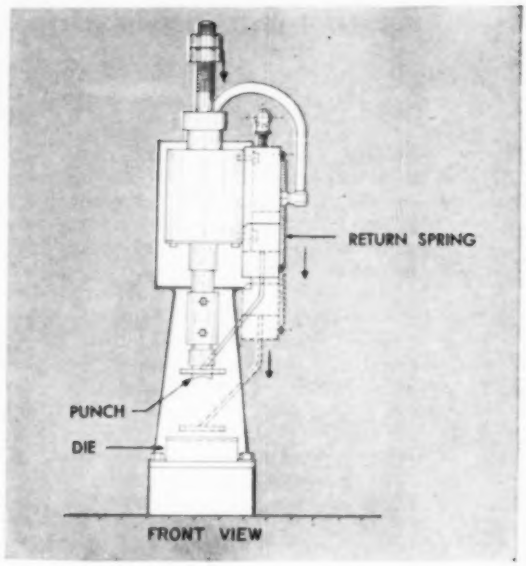
But now it is recommended that each of the five sizes have its own mounting flange width, i.e, 16 in. for Size 1, 19 in. for Size 2, 25 in. for Size 3, 31 in. for Size 4, and 39 in. for Size 5. As a result, mounting flanges would be no bigger than necessary—in contrast with the old dimensions which would have been too large in many instances.

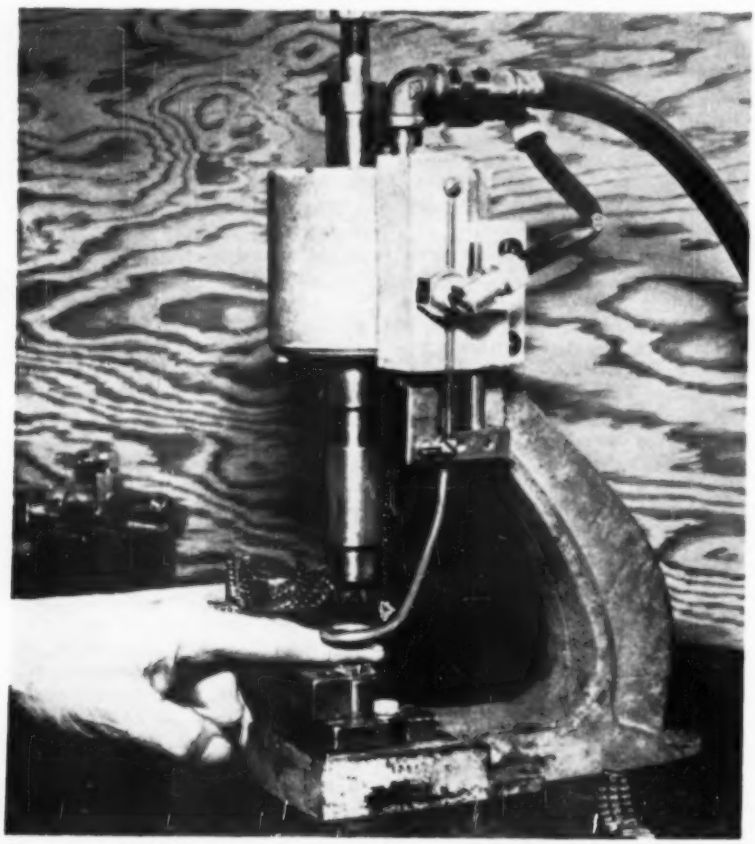
Center distances of mounting attach holes have been changed to suit the smaller dimensions: for Sizes 1 through 5 center distances are now, respectively, 13½ in., 16½ in., 22½ in., 28½ in., and 36½ in. This compares with the old 20 in. for Size 1, 30 in. for Sizes 2, 3 and 4, and 40 in. for Size 5. As a result of changing these basic dimensions other changes have followed logically:

- Widths of wing bases has been shortened 2 in. from the previously recommended 13 in. for Size 1, 16 in. for Size 2, 22 in. for Size 3, 28 in. for Size 4, and 36 in. for Size 5.
- Length of wing bases has also been reduced from previous recommendations by 1½ in .for all five sizes, is now (from Size 1 through Size 5, respectively) 36, 45, 63, 75 and 81 inches.
- Center distances of bolt holes on all feed unit bases in platens (upon which feed units are mounted on wing bases) have been reduced by 2 in., are now 7, 10, 16, 22 and 30 in. respectively.
- Overall length dimensions on way-type feed units are shorter, too—are now 28½, 37½, 55½, 67½ and 73½ in. for Sizes 1 to 5 respectively, compared with a previously recommended 30, 39, 57, 69 and 75 in.
- Also changed is the formula for determining the length of long feed unit faces. This dimension formerly equalled length of platen plus length of stroke plus 3 in. Now, it equals the sum of these two dimensions plus 1½ in.

Ring guard increases bench-press output

A smart rap on the finger, instead of injury or amputation, tells the operator when she is working too close to the punch.





Ring guard "senses" the finger and prevents the ram from coming down, notwithstanding air pressure is applied

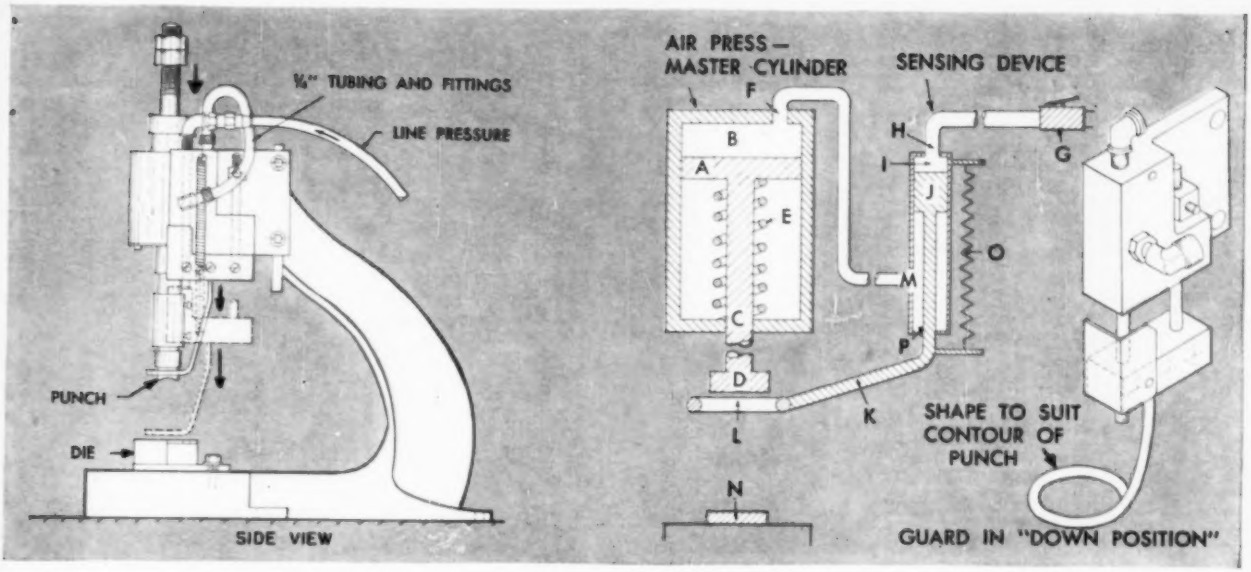
Many assembly operations on bench presses involve parts so small that it is seemingly impossible to keep the fingers out of danger—at least for long. If adequate safety can be maintained, however, operator morale and output will increase.

Fortunately, the old kick press is being converted in many shops to pneumatic operation, or pneumatic bench presses are being installed for light manufacturing operations. With air-powered equipment, a chance for safe control of punch movement is introduced.

The safeguarding of the presses is, however, not a matter that is solved at first glance. Watchbands, Inc., North Attleboro, Mass, knew this. Yet they wanted adequate safety measures to eliminate even minor injuries to their operators' fingers.

Watchbands, Inc. uses a large number of air presses for assembly jobs. Due to the nature of the product, many parts must be handled primarily with the fingers. Injuries to skilled as well as unskilled workers were unavoidable. These injuries arose despite the fact that the ram's stroke was controlled by speed and pressure-control valves.

A loss-prevention engineer had been assigned by the Liberty Mutual Insurance Co, to assist the jewelry manufacturer in developing safe press-room practices. As a result a report was made to Liberty Mutual's Research Center at Hopkinton, Mass. There, it became apparent to Dr Willem S Frederik, director of research, and his staff that some kind of a "sensing" device must be developed. This device would have to be able



to distinguish between a safe and an unsafe condition at the point of operation, and be capable of preventing the ram from completing its stroke, even though very close to the die, if an unsafe condition exists.

Because it was found virtually impossible to stop and/or return the moving ram instantaneously, the idea of stopping the moving punch before it could reach the fingers was abandoned. It seemed more logical to make the press inoperative if any dangerous condition existed. This could be accomplished by blocking the ram mechanically, thus counteracting the induced air pressure in the cylinder.

However, it would be preferable if the sensing device could prevent air from entering the master cylinder. Many models, based upon these ideas, were developed and rejected because of complexity of design, possible interference of guards with press operation, high cost of safeguarding equipment, doubtful reliability, etc.

The final product of this research was a novel ring guard that successfully overcame all of the various problems. In operation, this guard is controlled by a sequence cylinder connected to the master cylinder of the air press. If the ring guard contacts or touches any part of the operator's hand or finger, the piston does not complete its stroke and the air pressure port to the master cylinder remains closed. The punch then becomes inoperative.

Upon completion of tests, simulating actual working conditions at the jewelry manufacturer's plant, a representative from Watchbands Inc, visited the Research Center.

"When I first discussed this problem," stated Mr John Mushey, treasurer, "I was not too optimistic that the research people and scientists at Hopkinton would come up with a workable solution.

"We tried and considered the various safety devices and guards currently available on the market, but could not find anything feasible because they either interfered with efficient operation, or we were stymied for clearance due to the small space that we had to work with.

"I was agreeably surprised and very much impressed when I visited the laboratory and was shown one of our presses set up with the safety ring, which was designed and developed by Liberty Mutual, in operation."

To date, all of Watchband Inc.'s machines have been equipped with the new safeguarding device. "They are working perfectly," concludes Mr. Mushey, "have not interfered in any way with production. Most important, they have eliminated finger injuries to our operators and dispelled their fear of possible injury. There has also been a sharp increase in morale."

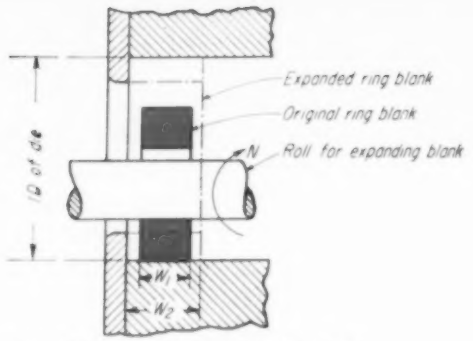
Principle of Operation . . .

This sketch represents a standard pneumatic bench press in combination with the newly developed safeguarding device.

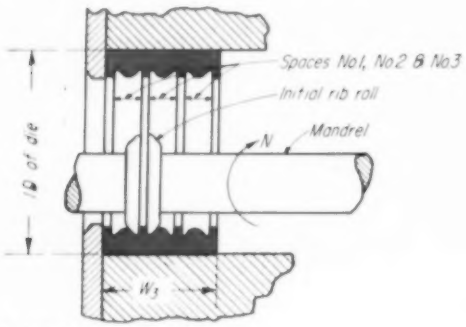
Piston *A*, sliding in cylinder *B*, is connected by means of rod *C* with punch *D*. Spring *E* returns piston *A* to its highest position after the air pressure is released. Air enters cylinder *B* through port *F*. Without the safety device, the foot-operated valve *G* admits air from the storage tank directly to inlet *F*.

With the sensing device installed, the air admitted through valve *G*, now enters port *H* into the auxiliary small-diameter cylinder *I*. Piston *J* in cylinder *I* is directly connected by means of rod *K* with the "ring" guard *L* which fits snugly around punch *D*. The air pressure will depress piston *J*, allowing air to to enter main cylinder *B* through the orifice *M* in cylinder *I*.

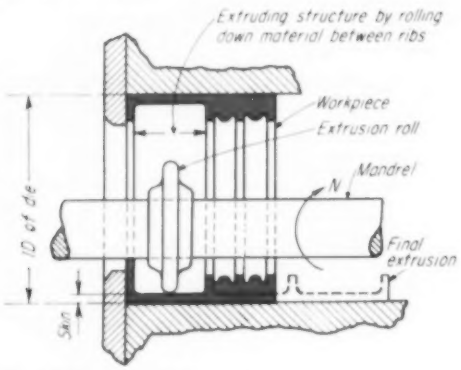
Air can enter the main cylinder only under the condition that piston *J* has passed beyond orifice *M*. Any obstruction between punch *D* and die *N* will prevent the ring guard *L* and its attached piston *J* from traveling downward sufficiently to open port *M*. After releasing the pressure, piston *J* is returned to its highest position by spring *O*. The air in main cylinder *B* exhausts through port *P*, by way of inlet *F* and orifice *M*, allowing spring *E* to return piston *A* to its original position.



Expand Original Blank Against ID of die

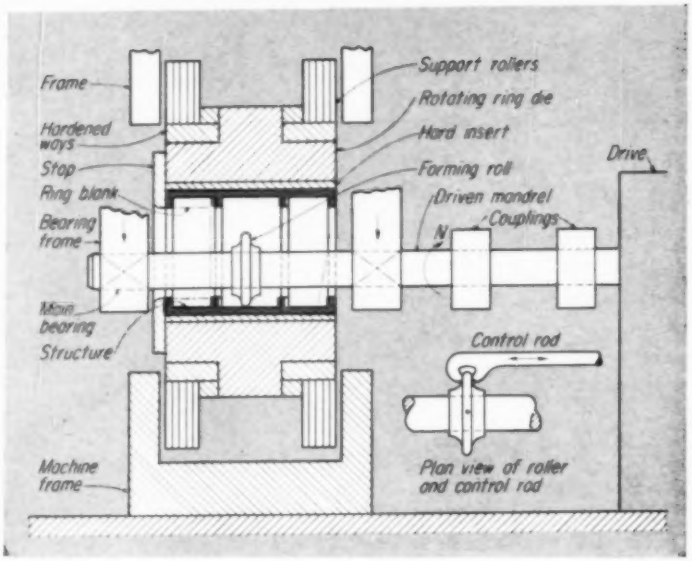


Initial Rolling of Rib



Axial Extrusion of Structure

Roll extrusion starts with expanding original blank in die—radially and axially (from W_1 to W_2). Second step is to produce ribs and increase length to W_3. Axial extrusion, increasing height of integral ribs, and ironing skin to final dimensions is the third step. Cut-away section is copper with integral ribs and a skin thickness of 0.010 in.



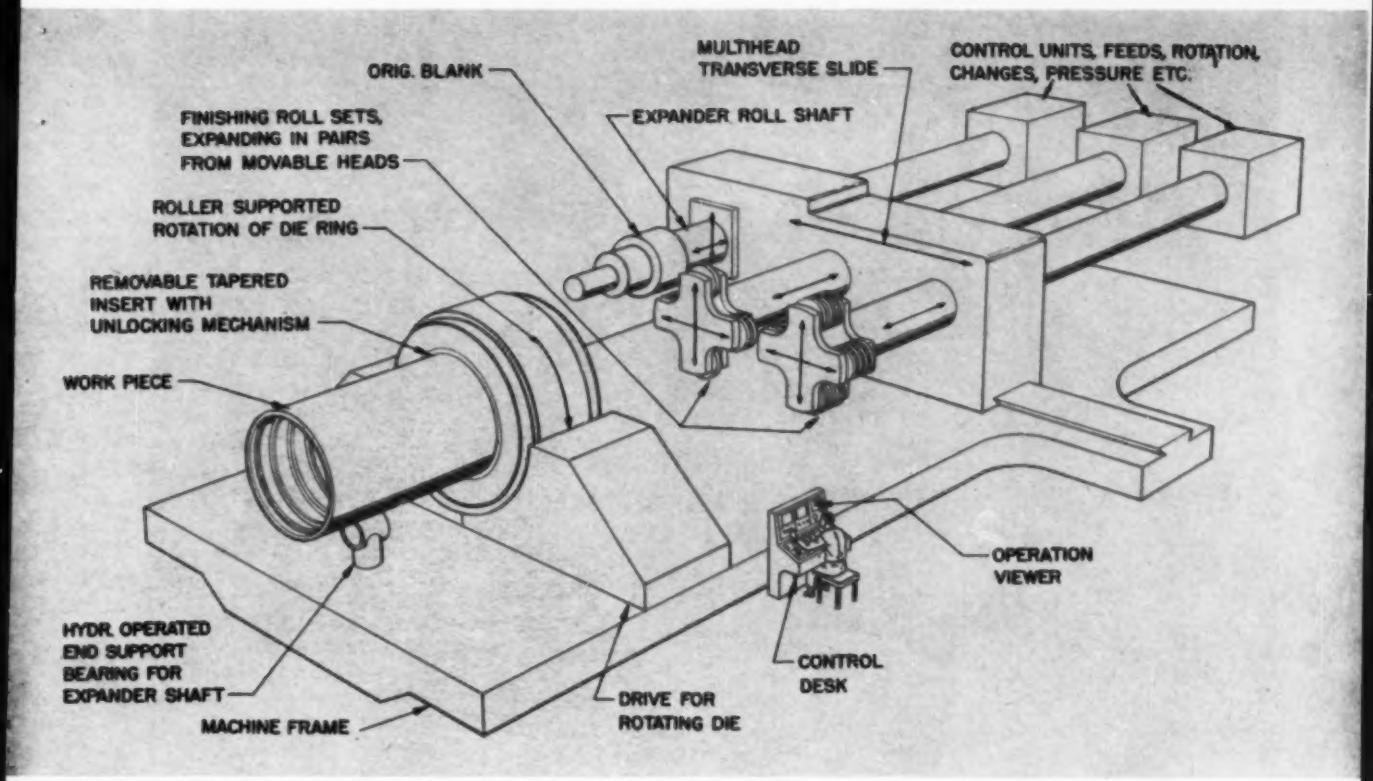
Roll-extrusion mill for integrally stiffened structures will be built for high-speed rolling action with roll pressure of approximately 400,000 psi. Forming roll that expands ring blanks and forms ribs rotates on a mandrel and is controlled for radial and axial movement through a transverse slide. It can also be skewed by a control rod for helical movement to continuously iron the material between rib boundaries for accurately spaced ribs or integral baffles of any desired thickness or shape

"Roll Extrusion"

By Adolph W Ernestus,
producibility methods,
Lockheed Aircraft Corp

. . . combines the accuracy of die extrusion, the simplicity of spinning, and the flexibility of contour rolling to produce integrally stiffened panels, cylinders, cones, and other special shapes in heat-resistant steel alloys and light metals. Pressure requirements are low and production rates high. Metal is displaced in compression rather than by shearing in this new metalworking development.

Roll extrusion is a big step toward eliminating bits and pieces and rivets and bolts in the construction of missile and airframe components. Large diameter, thin-wall structures with integral flanges, ribs, and stiffeners can be produced in cones, cylinders, panels, and other structures. Nearly 100% of the original blank is utilized in doing such work—compared with only 25% utilized in other methods. From the results already obtained with a prototype roll ex-


ORIG. BLANK
MULTIHEAD TRANSVERSE SLIDE
CONTROL UNITS, FEEDS, ROTATION, CHANGES, PRESSURE ETC.
FINISHING ROLL SETS, EXPANDING IN PAIRS FROM MOVABLE HEADS
EXPANDER ROLL SHAFT
ROLLER SUPPORTED ROTATION OF DIE RING
REMOVABLE TAPERED INSERT WITH UNLOCKING MECHANISM
WORK PIECE
OPERATION VIEWER
HYDR. OPERATED END SUPPORT BEARING FOR EXPANDER SHAFT
CONTROL DESK
DRIVE FOR ROTATING DIE
MACHINE FRAME

a NEW metal-forming technique . . .

trusion mill, savings in expensive raw material will be high in producing contoured missile structures, jet-engine housings, fuselage sections, hollow flanged shapes, torpedo flasks, and other parts. Experiments to date have produced excellent results in forming aluminum, copper, titanium, and stainless steel. Even 4340 steel has been successfully roll extruded with heat.

Design of roll-extrusion equipment capable of producing parts up to 10 ft in dia. and 24 ft long is now being evaluated by the Hufford Corp of El Segundo, Cal, under a licensing agreement with Lockheed.

In some ways, roll extrusion is similar to roll-forming, but there are a number of significant differences. The most important is that metal is formed in compression rather than by shearing forces. Another is that asymetrical as well as symetrical shapes can be produced with the desired integral configurations.

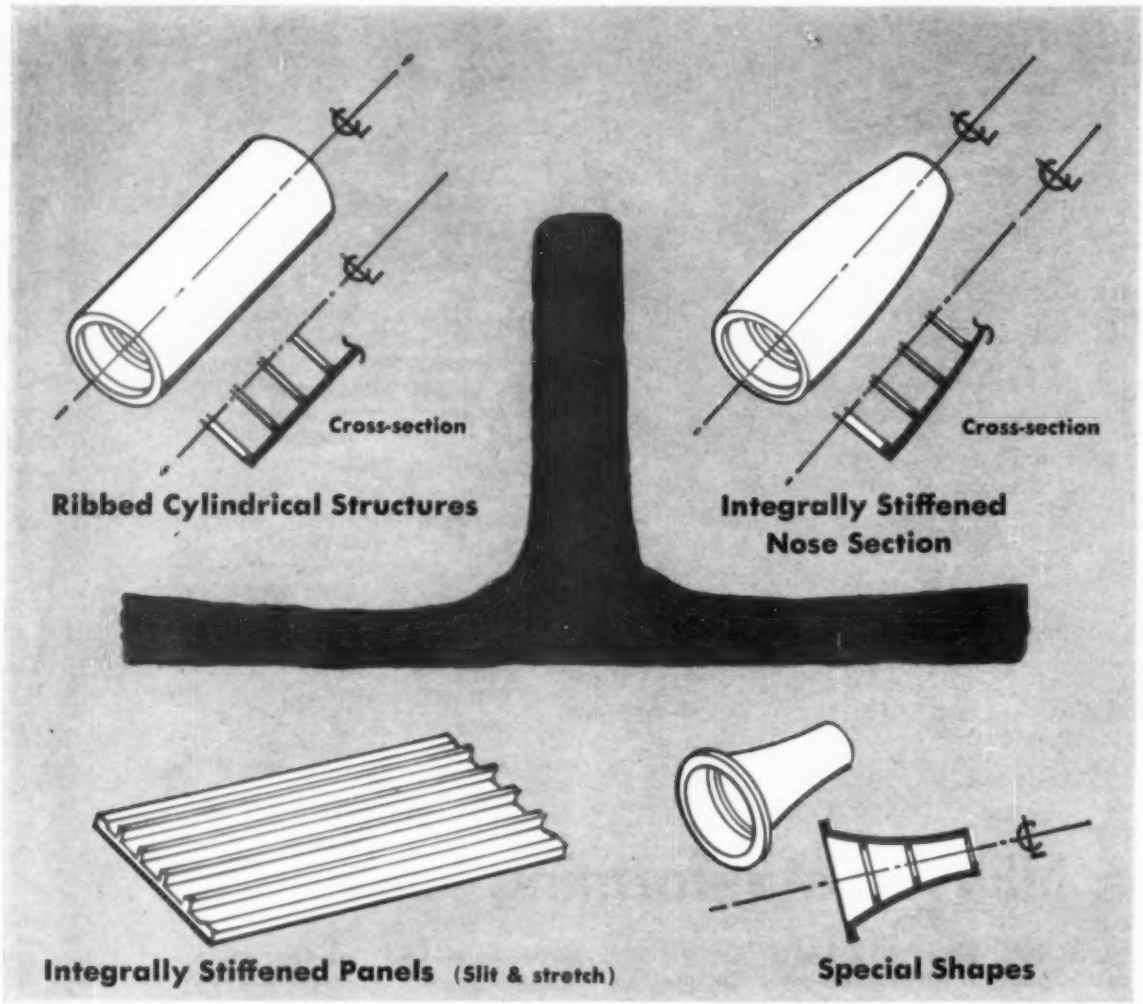
Where roll forming cannot produce thin-wall sections and high ribs, roll extrusion has achieved wall thickness to rib-height ratios of 1:15. In large-dia structures this ratio may reach 1:100. A high degree of accuracy is obtained in reaching wall thickness of 0.010 in. and less.

The roll-extrusion process generally deforms the crystal structure by compression to obtain flow lines and improved properties in the part.

In the simplest applications, a ring blank is placed inside a rotating die having the diameter required for the OD of the finished part. A roll expander on a multihead transverse slide rotates about its own axes inside the blank in contact with the ID—forcing the blank to expand radially and axially. Die ID controls the OD of the finished part, while length is controlled by the volume of the original blank and the amount of radial expansion obtained. When radial ribs are required in such an expanded blank, the procedure is the same except the blank is confined axially—at both ends as in closed-die forming. A suitable roll on the mandrel or expander moves axially as it rotates to squeeze the metal before it to raise the ribs. This step follows expanding the ring to the desired OD and includes additional axial extrusion. Any number of ribs of any shape desired are thus produced—one at a time, as the roll progresses from one end of the blank to the other. Spacing between the ribs is controlled by the axial movement of the expander and roll. By using suitable rolls, integral stiffeners with T, L, or bulb cross-sections can be produced. For high ribs, pinch-roll sets and form-rollers are applied before rolling down the material between the ribs.

In producing integrally stiffened cylindrical structures that vary in wall thickness, only one end of the blank is confined. The preceding steps are followed by rolling the material between the ribs to the required thickness (and length) while the part extends axially beyond the end of the rotating die.

Panels with integral stiffeners are produced in the same way; by first forming the cylindrical shape and

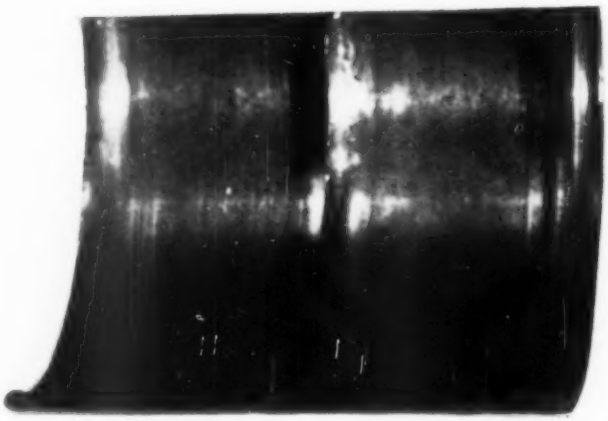


Rolling, rather than shearing, provides close control over grain size as well as good flow lines in rib sections. Typical structures produced by roll extrusion are produced in far less time than is required with other processes. For example, one structure that previously took Lockheed Aircraft 48-hr to form was roll extruded in 15-min

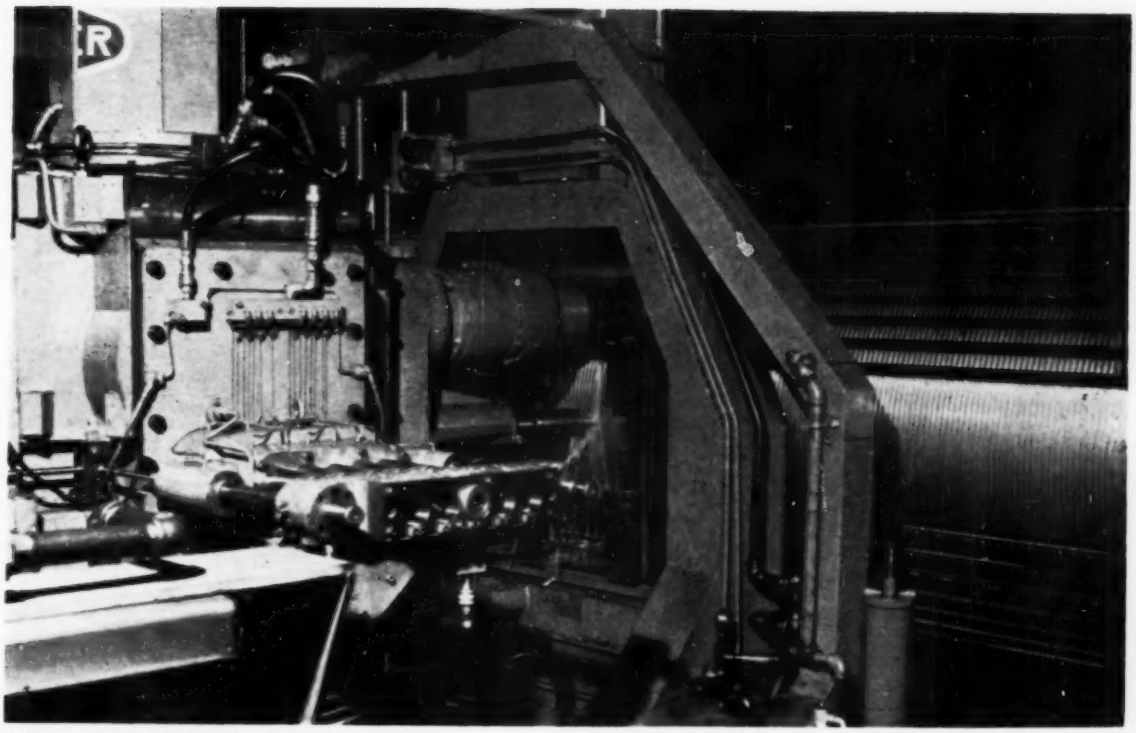
then slitting and flattening it. Tapered panels are thus made from tapered cylinders, and any of the various integral rib shapes possible in cylindrical sections can be produced in flat panels.

Any of these operations may be performed hot or at room temperature, depending upon the requirements of the metal being worked. Facilities for heating and quenching will be incorporated in the production machine.

Recent prototype work has indicated that waffle patterns and honeycomb lattices can be roll-extruded efficiently. This will permit a much wider use of these structures, so attractive from the standpoint of weight and strength.



A 1:15 ratio between wall thickness and rib height was roll extruded in this copper sample. With the work confined in a die, metal flow is radial and is squeezed up between slightly offset rollers.



Drilling about 3000 holes . . . in each turbine rotor limited the shop to three rotors a year. In addition, each hole had a milled indent. Numerically controlled from standard 8-channel punched paper tape, this Baker Bros. machine has upped production capability to 12 rotors per year. Large four-sided turret moves on ways toward or away from rotor for drilling. Carriage, complete with operator, moves along length of rotor body for positioning. At any one position, machine can drill, ream, roundbottom or mill, or perform any reasonable combination of four different operations in succession using multiple spindles. An incorrect hole can mean $50,000 worth of scrap; it cannot be filled by welding. In addition to higher output, numerical control offers considerably less danger of error than manual control of these operations

World's largest job shop reverses a trend . . .

Back to "Specials" for big jobs

A sharp change in manufacturing philosophy is taking place in the "World's largest job shop"—General Electric's Large Steam Turbine and Generator Department, Schenectady, N Y. The change involves a complete about-face from the Department's policy of using general-purpose equipment to achieve maximum flexibility and wide application.

Now, GE is buying highly specialized machine tools, designed to produce a particular part, and letting flexibility go by the boards. Why? William E Saupe, General manager of the Department puts it this way, "Our primary need is for maximum productivity. Flexibility *is* valuable in shops of this nature, but productivity can no longer be sacrificed to permit it."

To implement its policy of imaginative manufacturing engineering, the Department has just installed 20 new and highly specialized machine tools—five of them excellent operating examples of numerical control in action.

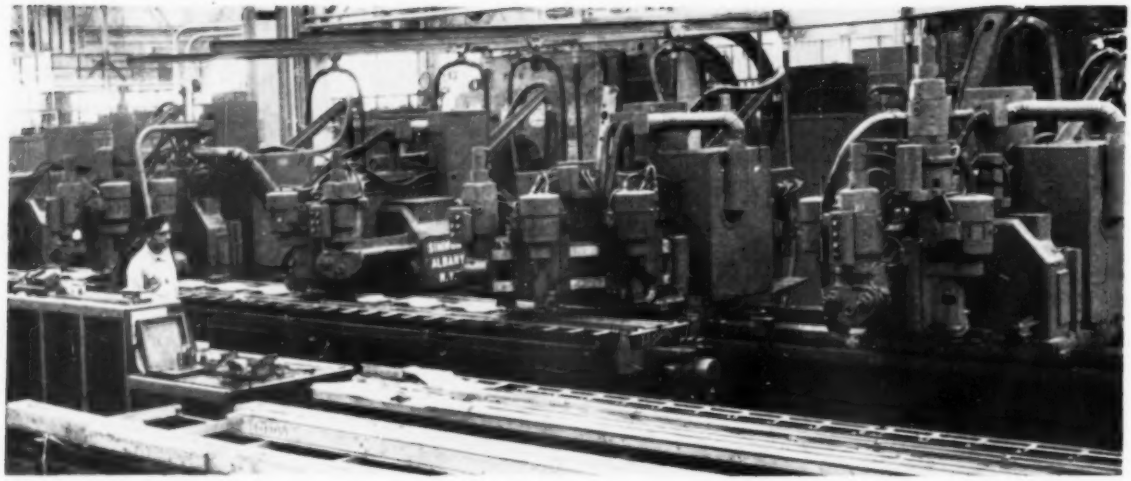
Another advantage in developing special-purpose equipment was described by H R Hill, manager of manufacturing for LST-G. Today, most manufacturing organizations have restrictive clauses in their union contracts. These clauses usually state that established piece prices can be changed only by a change in manufacturing method—a new job.

Clauses of this kind create serious problems of interpretation when old equipment is retooled or when automatic indexing, loading, holding, and similar equipment is applied to existing machine tools. Manufacturing must constantly work in the direction of new and substantially different equipment. Thus, in reality, a new job is created, and disputes over methods changes are avoided.

One way to create this new machine or process is by using numerical control. Furthermore, as has been said many times, numerical control is most practical for short-run, job-shop operations. Installation of five NC systems—one continuous-path and four positioning systems—developed by GE's Specialty Control Dept., in conjunction with the machine-tool builders, has quickly demonstrated their advantages, Productivity has been increased from 4 to 15 times over former methods.

New Machines

For many years the LST-G Department has had most of its cutting tools ground and set in a toolroom. Trouble was common. Operators claimed the tools were poorly ground and toolgrinders said the operators abused the tools. Now, with the oper-



Two decks of punched cards . . .
simultaneously instruct this highly complex machine, built by Simmons Machine Tool Corp., in manufacturing copper cooling conductors for generators. Normally, about 300 pairs of bars—in some 150 varieties—are formed into a set of coils for each generator rotor. The bars, about 25 ft long, are machined from extrusions on this 100-ft-long machine. Manipulating up to 30 functions and performing 250 cutting operations, the machine is believed to have the largest number of functions controlled from a single numerical system. The machine inserts slugs to block passages, welds them and then machines the assembly

ator's work reduced by numerical control and other automatic equipment, toolgrinders have been installed adjacent to the machines. Operators grind their own tools. On the giant 18.5-ft. Ingersoll planer-miller, a toolgrinder was added to the two-man operating team, a grinding machine was installed near the planer-miller—and the team is payed for its work as a unit. No more problems!

This miller will handle work 18½ ft wide by 19 ft high. It has four milling heads, each powered by 100 hp; one head is on each side and two heads are on the rail. Two tables permit one to be set up while the other is operating. Joints for turbine shells are milled so accurately, even with extension spindles, that they are assembled steam-tight without further grinding or scraping.

To bore ID's of turbine exhaust hoods up to 20-ft long, a Betts 16-in. horizontal boring machine was installed. Powered by a 100-hp motor, it moves the tool axially by moving the entire boring headstock and 16 in. bar. Radial tool movement is actuated through a rack in the bar which engages gears in the tool-carrying catheads. The operator can determine the tool position from the headstock, or he can control the machine remotely while standing near the point of cutting. Normally, this machine finishes a hood in 40% of the time required by the former Barret-Bar method.

Drilling holes often sounds easy. This is not true for the holes in the horizontal joints of turbine outer shells. These bolt holes are often 6 to 7 in. deep, and the material is alloy steel. Generally, horizontal drill-presses are used, and GE expects to continue using these presses on its smaller shells. However, for the larger ones, which are difficult to stand on end, two special Cincinnati-Bickford Giddings & Lewis radial drills have been purchased. They are the largest ever built.

These drills have a 34-in.-dia column and only a 10-foot arm to limit the deflection characteristic of radial drills. They have complete pendant control except for sluing of the column—which has power assist.

A new Ingersoll slotter increases LST-G's capacity for cutting slots in generator rotors. Indexing of the rotor is done automatically and the electrical controls provided keep the two cutters synchronized in space so that the cutting teeth are entered into both sides simultaneously. This minimizes vibration of the work. Without undue cutter wear or machine distress, slots 1½ in. wide and 6 in. deep have been cut, at a feed rate of 6 in. a minute—with carbide.

An automatic cutter grinder developed by Ingersoll improves the quality of cutter grinding for large slotters. Cutting on the flanks, on the rim, and around the radii is perfectly controlled.

Two Hammond machines for grinding carbide tool bits use the Anocut process. This process uses a metal bonded diamond wheel in combination with deplating, by an electric current, to remove metal at a rapid rate without danger of overheating.

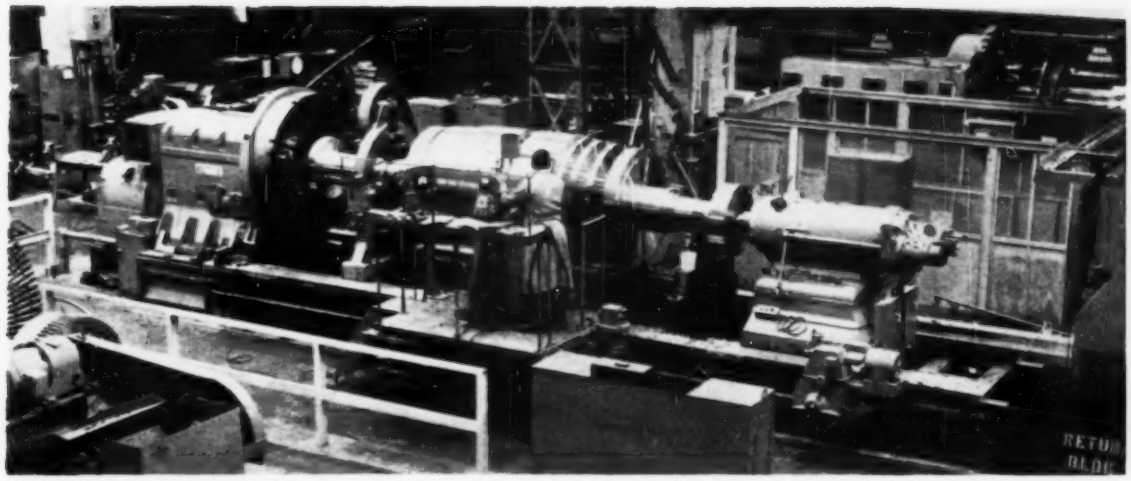
The first automatic slab-mill grinder built in this country, by Cincinnati, is used by the man who uses the slab mill.

Kearney and Trecker supplied two vertical boring mills with two special rams; both can enter a small hole to permit heavy, double-boring cuts simultaneously. The tables have holes in their centers to drop the chips to conveyors which carry them to tote boxes. A tracer is provided to permit contouring. These machines are almost twice as fast in floor-to-floor time as their predecessors.

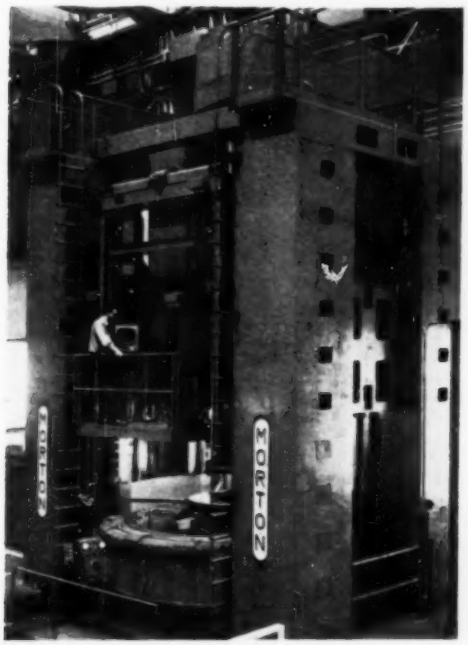
Two 8-in. horizontals, built by G A Gray, appear to be conventional machines. However, they were especially chosen and tooled for rough and finish boring valves; are almost twice as productive as previous standard models.

Two fairly conventional 6-spindle blade millers simultaneously reproduce the master shape of a turbine-bucket blade on six work-pieces. The unusual feature of these millers is their installation with several other tools to permit the operator, during the operating cycle of the miller, to perform one previous and two subsequent operations and to sharpen his own cutters on a special automatic cutter grinder.

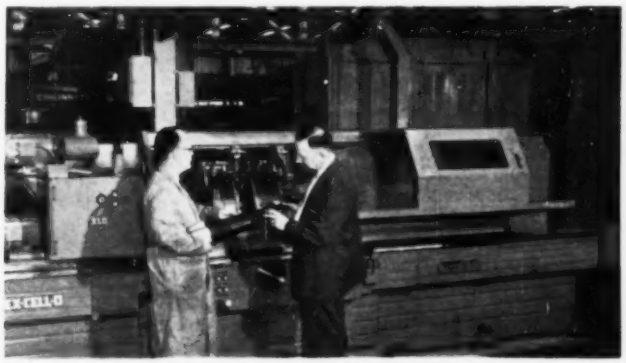
The finger-type dovetail construction used on the larger turbine buckets—to hold them on the wheels—requires reasonably accurate machining. The machining is heavy, and very rigid machines are required. Kearney & Trecker will deliver a 3-station rotary index machine for roughing and finishing this dovetail.



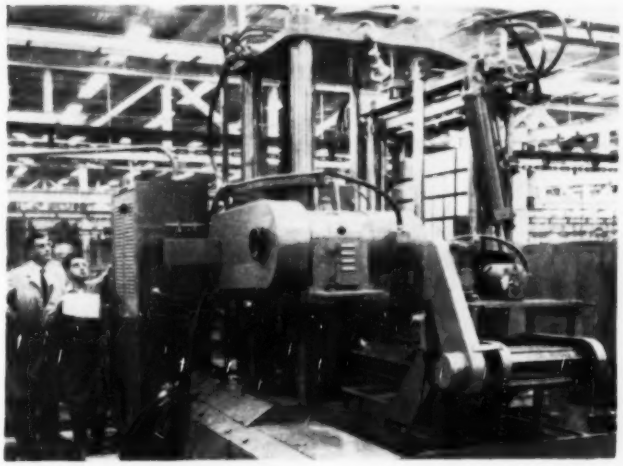
150 hp in the cut . . .
is the power poured into this heavy lathe built by Consolidated for deep-grooving turbine rotors. This machine takes a grooving cut 2 in. wide, 0.028 ipr, at 220 sfpm. A special electronic dimensioning system locates the carriage along the bed within 0.001 in. to eliminate the awkward measuring formerly necessary. Carboloy disposable inserts, turned only four times instead of to the customary eight positions, are used three at a time in a cutting tool which resembles the tools used for trepanning—to provide the same effect; small broken chips. A second, two-insert tool is used simultaneously on the rear slide



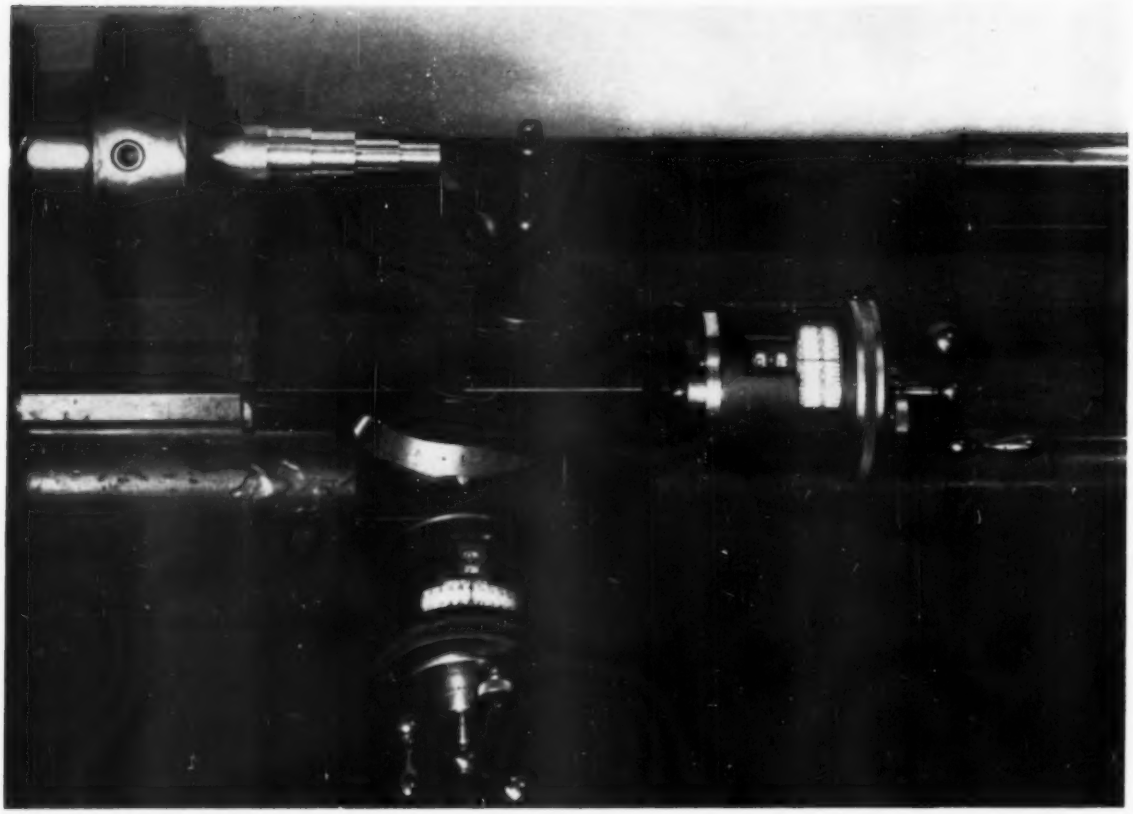
Three large vertical mills . . . ▶
are replaced by this single Morton stub-bar boring machine which was designed and built, at a cost of about $1 million, especially to rough the steel castings used for turbine inner shells. Visual tracing is provided by a frosted-glass panel above the operator's position. Television camera mounted on spindle nose provides image of cutting tool at work at operator's station



Exacting turbine-bucket contours . . .
are machined on this continuous-path numerically controlled machine built by Ex-Cello-O Corp. Four machines will operate from a single magnetic tape. The basic shape of the blade is computed on an IBM 704 computer and the same computer is used to determine the path of the center of the milling cutter. Tape from the computer is put through a director to produce a magnetic instruction tape



Drilling 8 to 10 ipm . . .
through 10-in.-thick plate, or 10 one-inch plates, this W. P. Hill Inc. numerically controlled drilling machine is one of the smaller machines in GE's Large Steam Turbine Generator Department. It will drill, ream, and bell-mouth 100 holes in 1½-in.-thick tube-sheets in 10 min



The Dimension Indicator . . .
gives direct readings of piece dimensions to 0.001 in. during tool travel. The longitudinal indicator shown here was not used in this evaluation test. One full turn of the handwheel moves the tool 0.100 in.

Direct dimension readings boost output and accuracy

By D A Gordon and B K Radhakrishnan
department of industrial engineering Univ of Michigan, Ann Arbor, Mich

Direct-reading dials that indicate tool travel can substantially reduce machining time and, at the same time, improve accuracy, especially where inexperienced operators are involved. Here are the results of tests on such a device. Most of the results are what you would expect; some are quite surprising.

The Dimension Indicator, a development of English Numbering Machines Ltd, England, was recently put through a series of tests here at the University's Willow Run Laboratories. The device reads directly to 0.001 in., and is calibrated by making a skimming cut upon a bar, measuring the turned diameter, and transferring this reading to the indicator. (The indicator can be released from the leadscrew for setting purposes.) Once set, the indicator gives an exact reading of diameter throughout tool travel.

Test setup

To evaluate this device, a Hardinge 9-in. lathe was equipped with a Dimension Indicator in place of the standard crossfeed dial, and a series of shoulders were cut on a 1 1/16-in.-dia aluminum bar. The same cuts were also made using the lathe with its standard crossfeed dial. In both devices, a full revolution of the crossfeed handwheel advances the tool 0.100 in.

The test bar diameters were so chosen that the first cut required three revolutions of the crossfeed handwheel; the second cut, two; the third, one; and the fourth, less than a full turn. The fifth through eighth cuts were similarly stepped.

Two different groups of operators took part in the test. One group was composed of university students with no prior lathe experience; the other was a group of machine shop workers with an average of 25 years of experience. Before the test began, each operator practiced on the lathe, made micrometer measurements, and had the direct-reading device demonstrated to him.

Each cut was begun with the tool 0.550 in. from the center of the work. Deep cuts were made to get close to the required diameter, and the work was finished with a fine skimming cut. Lathe stops held the length of cut to ¾ in. (The longitudinal Dimension Indicator shown in the

Machining time, test cuts

	Rotations of crossfeed crank 0-1	1-2	2-3	3-4	Mean
inexperienced operators (students)					
Time per shoulder, std crossfeed dial (min)	**4.93**	**5.57**	**7.22**	**9.69**	**6.85**
time for micrometer measurement (min)	2.51	2.83	3.24	4.32	3.22
cutting time (min)	2.42	2.74	3.98	5.37	3.63
Time per shoulder, Dimension Indicator (min)	**2.46**	**3.05**	**3.96**	**4.79**	**3.57**
% time saving (using Dimension Indicator)	**50.1**	**45.2**	**45.1**	**50.6**	**47.6**
% increase in production	**100.4**	**82.6**	**82.3**	**102.2**	**91.8**
experienced machinists					
Time per shoulder, std crossfeed dial (min)	**1.83**	**2.56**	**3.04**	**3.63**	**2.77**
time for micrometer measurement (min)	.78	1.09	1.18	1.40	1.11
cutting time (min)	1.05	1.47	1.86	2.23	1.66
Time per shoulder, Dimension Indicator (min)	**1.24**	**1.39**	**1.70**	**2.07**	**1.60**
% time saving (using Dimension Indicator)	**32.2**	**45.7**	**44.0**	**43.0**	**42.2**
% increase in production	**47.6**	**84.2**	**78.8**	**75.4**	**73.1**

Evaluation test results . . .
show how the Dimension Indicator helps boost output for both experienced and inexperienced operators. Accuracy was also considerably improved.

photo was not used in this test.) When a test bar had been completed, it was removed and measured to 0.0001 in. on a Pratt & Whitney supermicrometer.

Each time a shoulder was cut, readings were taken of the total work time, idle time, and the number of times the lathe was stopped. Idle time was that spent in taking micrometer readings; running time was total work time minus idle time.

Results

Both groups worked faster and more accurately using the Dimension Indicator. Only one of the 160 cuts made by the students while using this device showed an error of more than 0.008 in. The standard deviation of the 160 measurements was only 0.0019 in. With the standard crossfeed dial, the students produced 18 out-of-tolerance shoulders, and the standard deviation was 0.0195 in. And as you see from the chart, time savings ranged from 45.1 to 50.6% and averaged 47.6% for the student group.

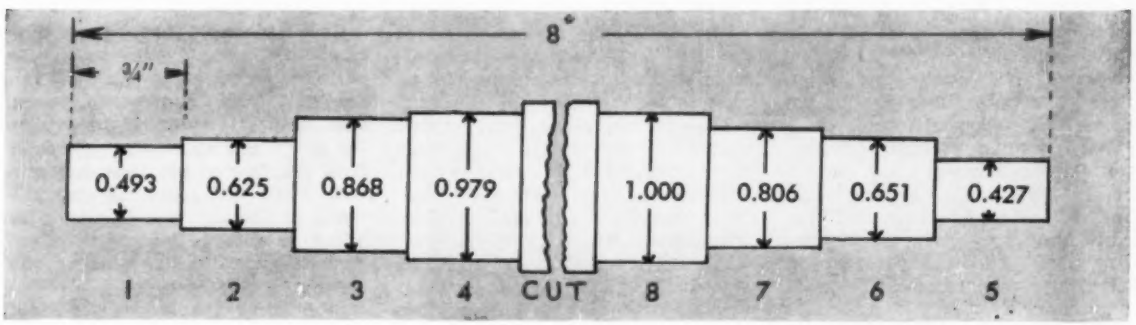
The experienced group, when using the device, turned out six cuts (out of 160) more inaccurate than 0.008 in. The standard deviation of the 160 cuts was 0.009 in. With the standard crossfeed dial, these operators produced ten out-of-tolerance cuts, and the standard deviation was 0.0117 in. Time savings ranged from 32.2 to 45.7% and averaged 42.2%.

Since the actual running time for the two devices differs by only 2.5% for the students and 3.6% for the experienced machinists, it is apparent that the Dimension Indicator chalks up considerable time savings by eliminating measuring time.

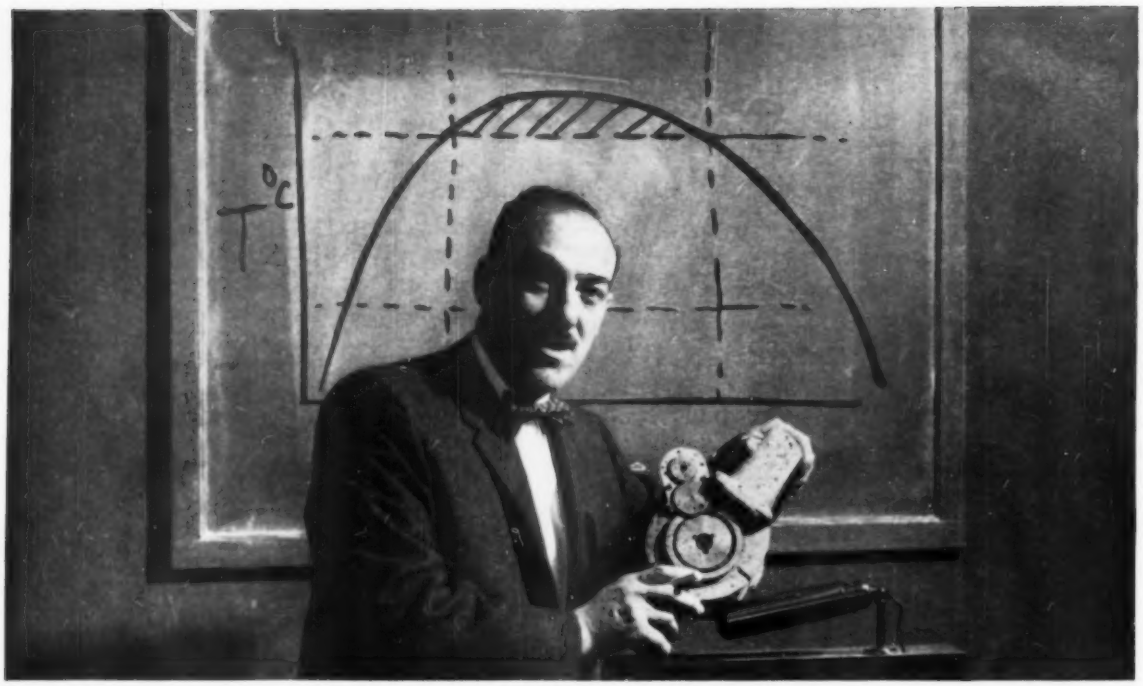
The superior accuracy can be attributed to the easily read counter and scale. By comparison, the standard crossfeed dial requires division and subtraction computations and the reading of the micrometer—operations in which there is considerable opportunity for human errors.

Errors in these two devices spring from different sources. Crossfeed dial errors are mainly human errors; the leadscrew and the graduated dial are accurate. Dimension Indicator errors are mainly equipment "errors." This is an important distinction. Equipment faults can usually be corrected through proper procurement and maintenance. Human error can be reduced only by relatively expensive personnel selection and training programs.

The fact that the experienced operators produced more out-of-tolerance cuts than did the students when using the Dimension Indicator was rather surprising. It may be the result of interference with a "habit" or technique repeated many times over a number of years, and it would be interesting to see if these findings generally occur with the introduction of new machining devices.



Test bar cuts . . .
were automatically timed, then measured on a Pratt & Whitney supermicrometer. After cuts 1 through 4 were made, the bar was reversed in the lathe and cuts 5 through 8 were made. Length of cut was limited by a lathe stop



Leo Myers uses case histories and informal discussion . . .

When metallurgy invades the shop

By H L Myers, head, Metallurgical Laboratory, Microwave and Power Tube Division, Raytheon Manufacturing Co, Waltham, Mass

The same problems, coming up again and again, were taking the time of the metallurgical staff at Raytheon. As the company grew it became impossible to handle them by individual explanations.

Typical problems presented as case histories to groups started the search for a solution. These developed into informal seminars that led to better understanding and application of materials and processes.

As one participant put it: "You come upon a problem and drop in on the metallurgist in his office. Invariably he is so busy that he can give you just a little piece of an answer. At the seminars you get lots of answers to lots of questions."

We had no way of knowing, when we started, whether such a proposal would meet with acceptance. To test our plan, we invited composite groups to attend on a voluntary basis a series of blackboard talks on fundamental metallurgical manufacturing processes.

We need not have worried about the reaction. The talks were popular from the beginning. Soon the word spread, and metallurgical training by the lecture method was a going thing at Raytheon.

Starting with the premise that certain problems are bound to come up again and again, we tabulated the most repetitious ones. After studying these, we decided that it would be possible to talk them over before varied personnel groups. While it was not our intention to make metallurgical specialists out of these people, we did want to make them aware of certain fundamental aspects of design and processes. We felt that in doing this we could, at the very least, help them to avoid some of the less obvious pitfalls associated with modern metallurgy.

We next concluded that the data should be presented in a pre-digested form, stripped of all non-essentials. Our lectures were therefore formulated on the basis of presenting intrinsic data only.

At first, the talks were held after working hours off company premises. Later, we found more or less permanent meeting places within the company.

There is some merit in holding meetings after hours because those who attend are people interested enough to spend their own time. But they have already done a day's work, are probably tired and anxious to seek a change in routine. As a result, their concentration is apt to suffer.

When the discussions are held during regular working hours, it is much easier to gain larger attendance. Many employees live long distances from the plant, and some are unable to make satisfactory transportation arrangements after hours. We decided to hold the meetings during the working day.

Once underway, the meetings lasted about an hour. A question-answer period followed, and this usually ran another thirty minutes or more. **One feature instituted at once was the habit of encouraging questions from the floor at any time during a talk.** While this broke the speaker's trend of thought, we found it far better to answer the questions immediately than to save them up and answer them at the end.

Since some people are shy about phrasing and asking questions extemporaneously, we provided pencil and paper so that questions could be written down. We were also care-

ful not to ridicule any question, no matter how far "off" it seemed. We wanted to gain confidence, not scare it away.

Rather than lecture a large group, we made it a habit to repeat the same material at several small sessions, limiting attendance to not over twenty each time. Wherever possible, we accented visual demonstrations to make the participants realize that we were presenting material of practical value, not mere theory. We made liberal use of slides, blackboards, and other visual aids, as well as actual metalwork samples. **No written material was passed out because experience showed that it only served to shortcut thinking, not to aid it.**

Each individual was encouraged to interpret answers to the questions brought up in terms of his own problems.

Limited to Essentials

The predigested lectures contained few if any mathematical, chemical, or physical computations. Purposely avoiding this kind of indoctrination, we simply outlined the essentials of good practice and the penalties for bad practice. We backed this up in every case with concrete examples showing how typical metalworking problems could be avoided.

The case history method seems to fit in well with this type of presentation. At the same time, it affords an opportunity to present new material, methods and processes. For example, the use of new brazing materials at Raytheon and other companies was introduced and their place in manufacturing illustrated.

Many questions from the floor centered about the new wonder metals: titanium, zirconium, the superalloys. We discussed how to cope with the problems associated with use of these new metals and alloys, and gave suggestions as to their use.

The following subjects were covered in these courses:

1. Practical metallurgy.
2. Heat treatment.
3. Copper and copper base alloys.
4. Nickel and nickel base alloys.
5. Iron and iron alloys.
6. Refractory metals.
7. Soldering and brazing.
8. Metals and methods.

In the series on soldering and brazing, we pointed out that soldering is probably the most familiar and most generally understood metallurgical operation. However, soldering is not as simple as it appears, for it involves several branches of science including chemistry, physics and metallurgy.

The talks on soldering included a theoretical discussion of phase diagrams and metals solubilities, as well as a practical discussion of the various alloys available, and the principles governing their formulation.

Questionnaires were distributed inviting participants to suggest problems to be discussed or discussions to be further amplified. Criticism of the course was invited.

Not only engineers of all types, but foremen, supervisors, engineering assistants—even some manufacturing personnel attended the courses.

In addition to coping with the recurring basic questions, the meetings serve to speed up internal communication of technological data.

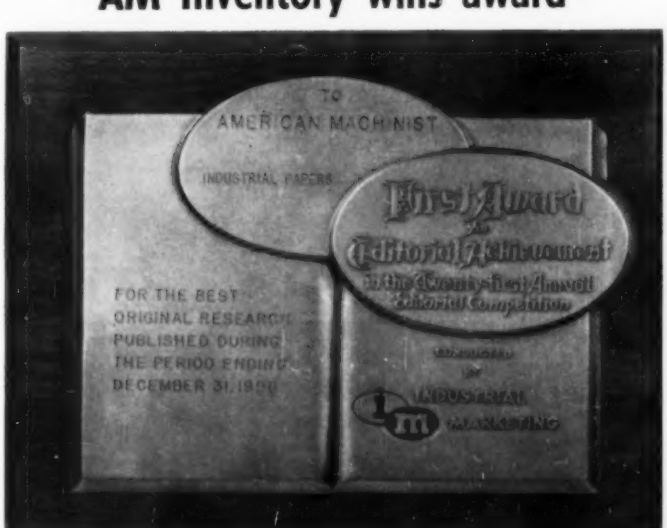
The discussions on metallurgy have resulted in much constructive thinking on the part of the engineers at Raytheon. The impression we try to leave is that it is important to think in terms of the use of new materials, processes and techniques. This should give a better grasp or conception of metallurgy, or how to overcome some of the problems involved, and to know why it is important to try new ways.

At the same time, we have made it clear that we are not trying to divorce the engineer from his specialty and marry him to metallurgy. Our aim is simply to provide him with useful knowledge about metals in a form that he can apply intelligently in his work.

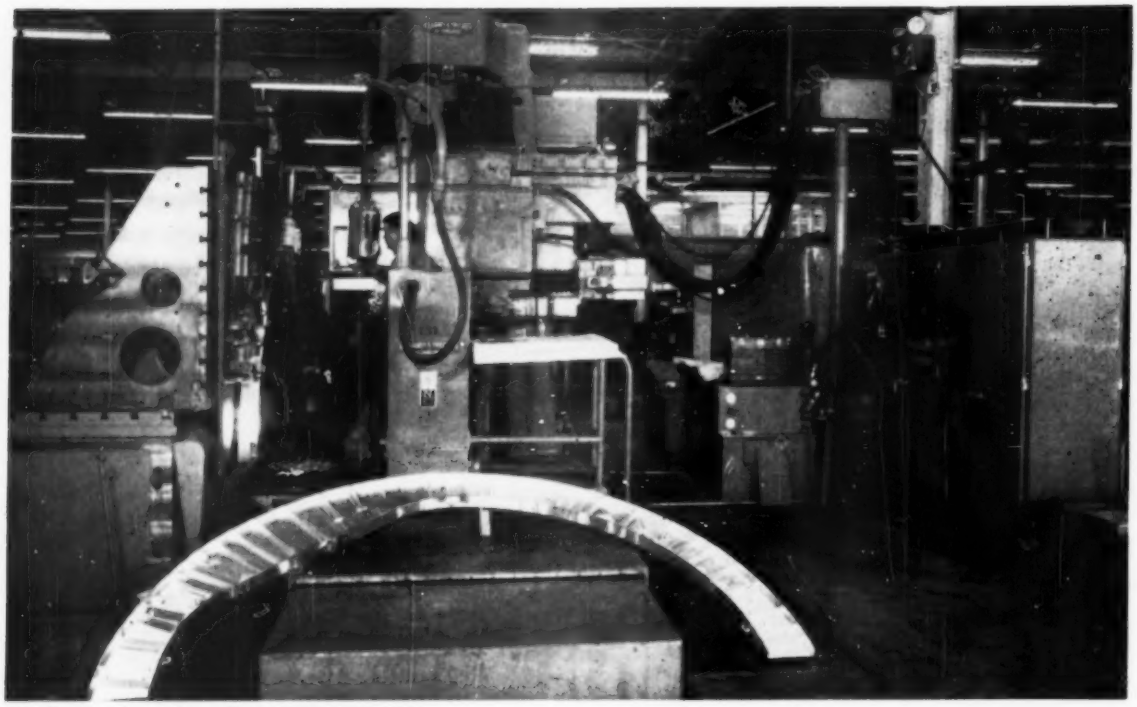
10 rules for informal training

1. **Make audience feel at ease.**
2. **Present pre-digested data.**
3. **Encourage questions from the floor—at any time.**
4. **Use visual aids.**
5. **Employ case histories.**
6. **Limit talks to sixty minutes.**
7. **Provide every criticism with a solution or answer.**
8. **Pass out no explanatory written material.**
9. **Insist on voluntary attendance.**
10. **Hold sessions during working hours.**

AM Inventory wins award

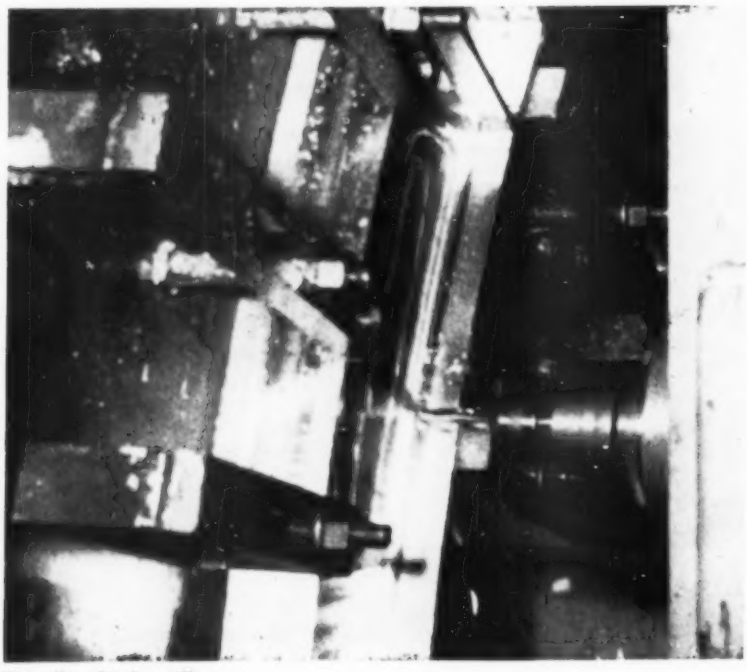


First Award for Best Original Research was won by AMERICAN MACHINIST for its Eighth Inventory of Metalworking Equipment (96 pages in the Nov 17 '58 issue) in the annual competition conducted by *Industrial Marketing* among industrial magazines.



Missile bulkhead is milled automatically . . .
at a 3-axis Kearney & Trecker miller equipped with numerical control. Punched tape guides cutter in and out of pockets in the beam

Atlas bulkheads cost less with



Spindle climb mills . . .
at 1800 rpm and 30 ipm to remove 450 lb of aluminum alloy. Total of 51 recesses, or pockets, is cut out

Numerical control saves 55% in machining time, 38% on tool cost, and 33% in lead time when thrust bulkheads for Atlas missiles are machined. The Bendix control works on a 3-axis Kearney & Trecker profiling and milling machine that automatically shapes the outside contour, cuts 36 pockets in the front face, and mills 15 pockets in the aft face of the curved beam.

Rough-sawed beams come from Convair-Ft Worth—they are 3 in. thick, 10 ft long, and 5 ft to the top of the arc. After machining, the 7075-T6 beams are reduced from 500 to 49 lb—450 lb of metal is removed by H & B American Machine Co, Indianapolis, where the miller is operated.

Machining time is now 60 hr, compared to 135 hr for conventional equipment. Tooling cost is $5800, compared to about $9500 for conventional milling. Lead time to produce the first part, once planning has started, is now 40 days, compared to 60 days for conventional methods.

Tape feeds through a photoelectric reader to control all machine motions and withdraw the cutter to a

Machine operates on tape control . . .
from Bendix console. Information is gathered in process sheets, then integrated in a computer that punches the tape

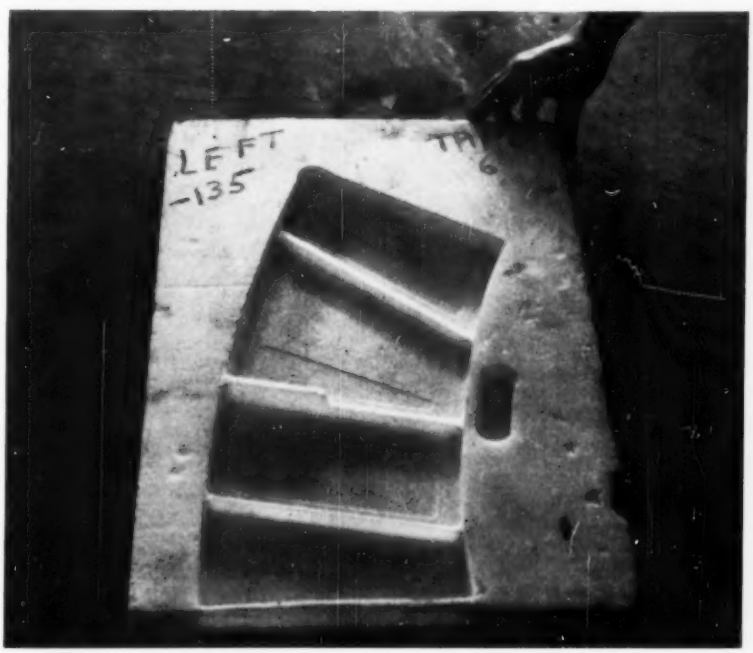
tape-controlled milling

By George H De Groat,
Detroit editor

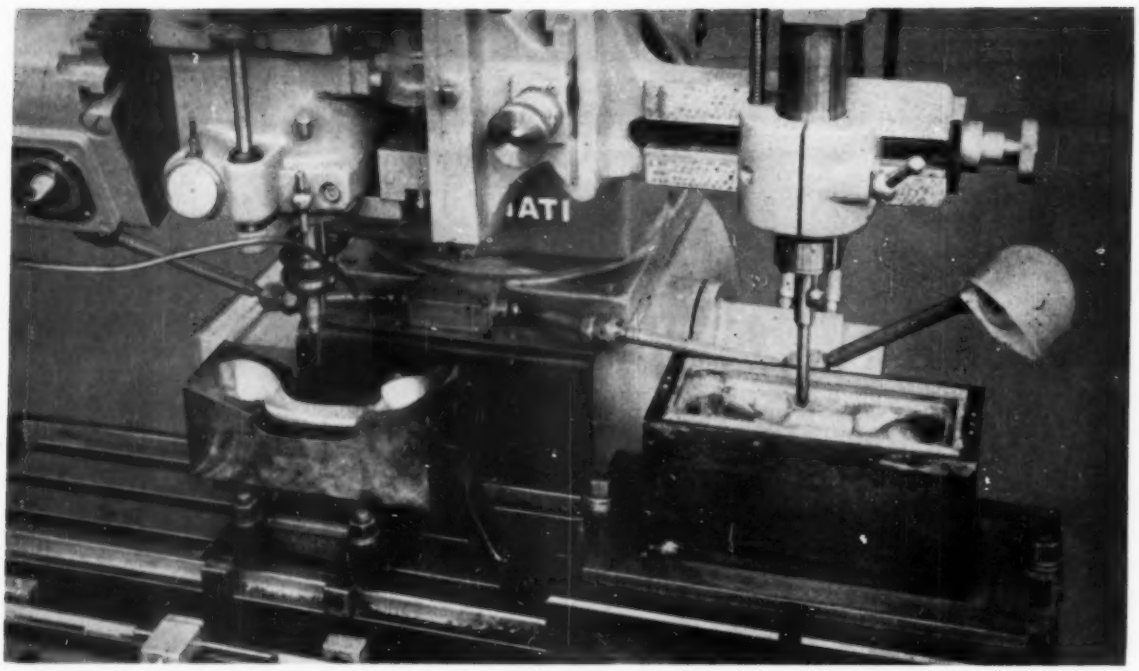
clearance plane when all surfaces have been machined. Spindle speeds are manually selected.

Tape preparation starts when dimensional data is organized along with cutter size, feed rates, and sequence of cuts. This information is sent to a Bendix tape-preparation center in Detroit, where IBM punched cards are prepared from the process sheet. Cards are verified to check their accuracy, then fed into a Bendix G-15D digital computer. The machine calculates cutter-center loci, interpolates intermediate points to produce a continuous cutter path in curved sections, resolves feed rates into machine-slide speeds, translates decimal input into binary code, arranges the results in a required format, and punches the tape.

Tapes are made with automatic pocket-milling routines, which are set up ahead of time for all cases. To these are added final dimensions, number of roughing cuts, depth of finishing cut, clearance plane, and cutter diameter for each pocket to be included on a given tape. The computer calculates the path for each complete pocket.



Plastic-foam test piece . . .
shows cutter operation to check program errors before a costly bulkhead is set up. Cost for foam blank is about $6.00

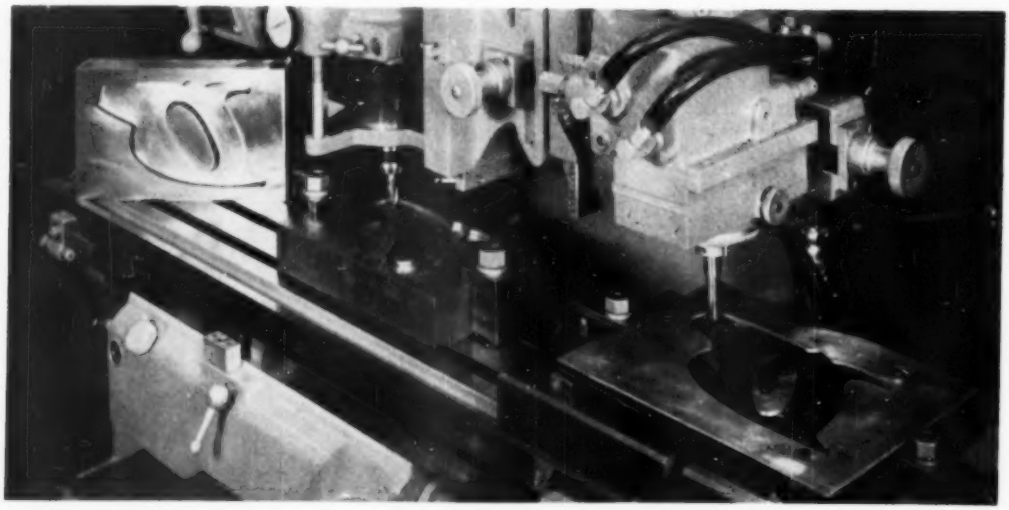


Automatic, hydraulic, depth-control tracer . . . guides a small knee-and-column die sinker to cut a mold for a telephone handset. Mold was cut in block of tool steel previously shaped to parting-line surface. Entire cavity portion of mold was roughed and finished on this machine in 7¾ hr, using 0.010 in. progression of finishing cut

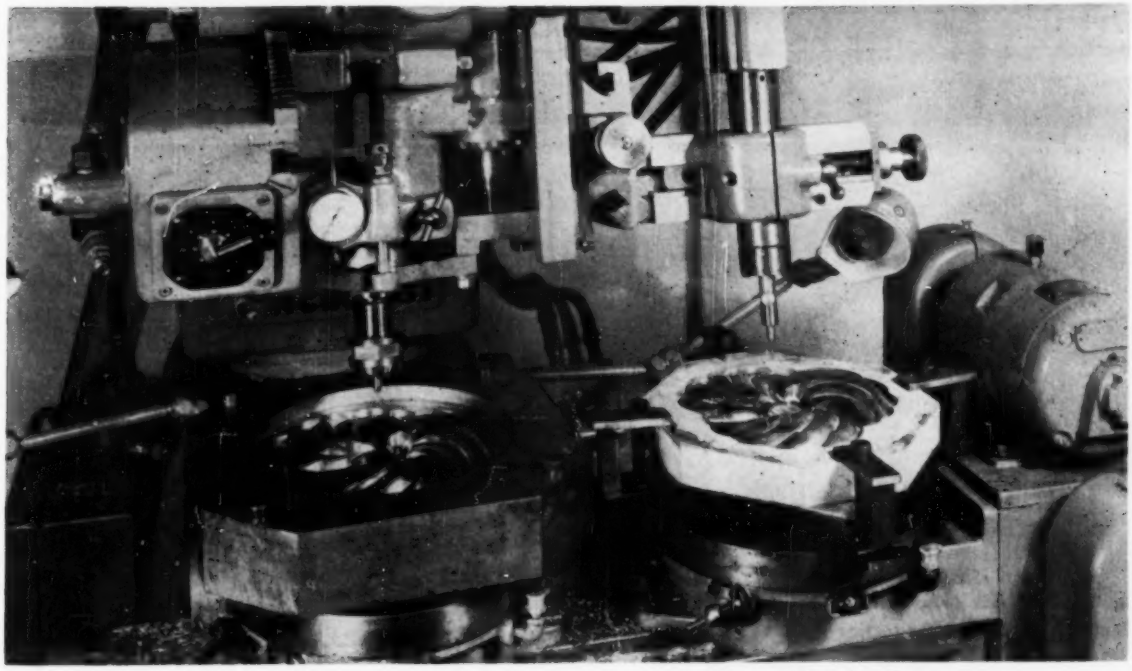
Modern methods

Two roads are open to today's plastic-mold maker. Going in one direction, he can cut the mold from die steel before it is hardened, using modern machine tools plus recently developed hydraulic duplicating equipment. The other

By E J Krabacher, senior research supervisor
P A Ropp, die-sinking specialist
The Cincinnati Milling Machine Co
Cincinnati 9, Ohio



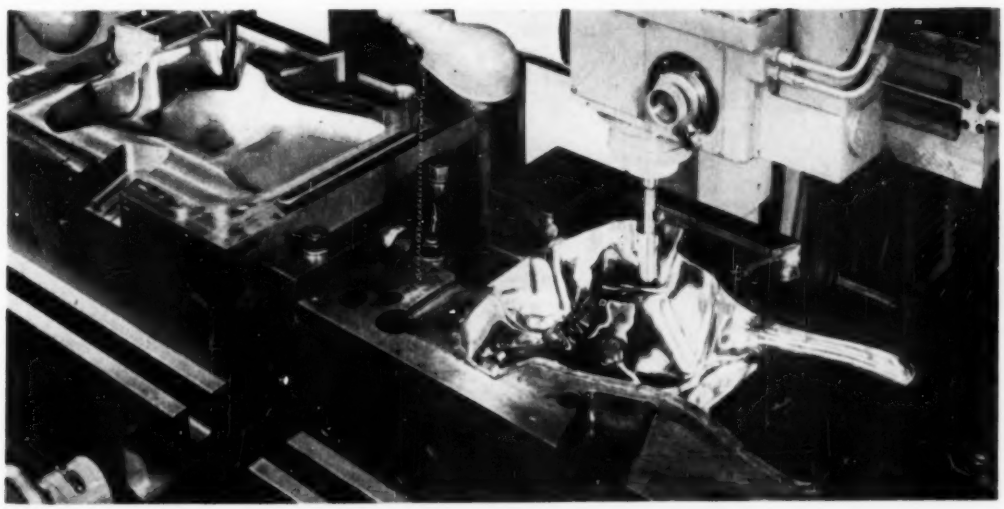
Hand control, on a tracer . . . is akin to power steering. Manual effort is amplified by hydraulic servos. This small die sinker, equipped with a three-dimensional hand tracer is producing a cavity for a plastic saw handle from a very simple master—a thin templet to give the inner and outer contour. Mounting the templet over a plate set at an angle to horizontal gave a tapered body to the cavity. Small die sinkers can also be equipped with linear and rotary automatic table cycles



To machine the sharp corner . . .
and small vertical wall at the edge of the cavity, spindle carrier is tilted slightly to the rear. Cut on a rotary setup, job is a large mold for a "lazy susan." It was cut from solid mold steel in 45 hr

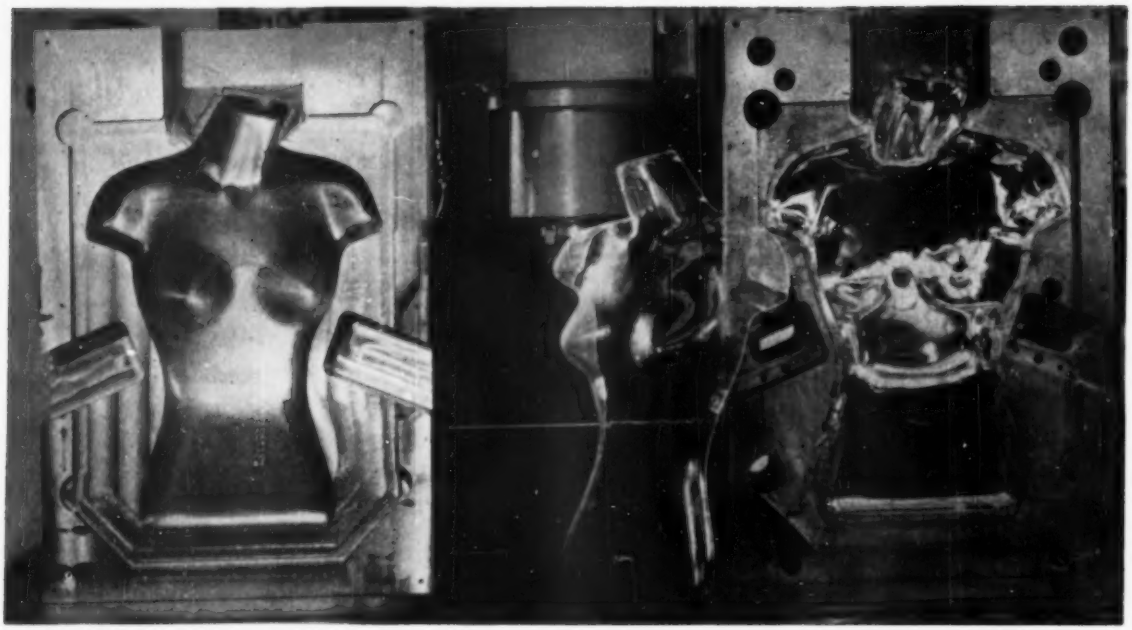
make plastic molds

road is newer, less traveled, and not always safe—but it can save hours of valuable time. Route Two calls for machining heat-treated die steels by electrical-discharge (spark) processes or by cutting the hard steels at elevated temperatures—"hot machining." Here's a quick guide.

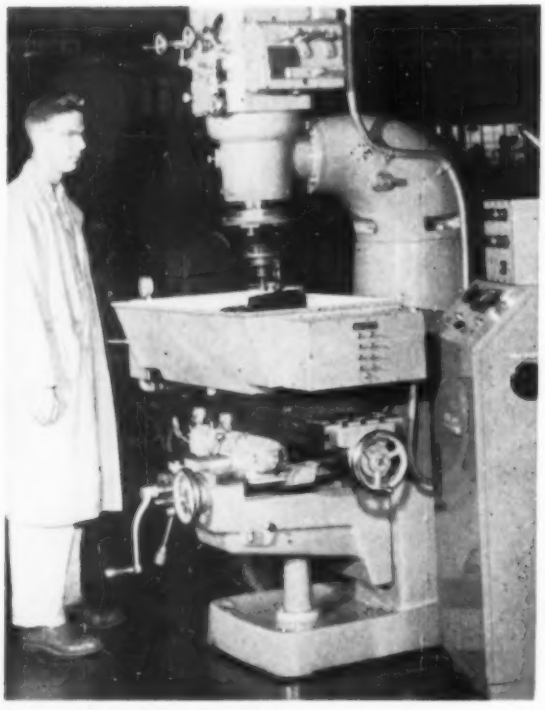


Fixed-bed machines . . .
are used for intermediate and larger work, to provide the rigid machine structure needed for heavy stock removal at a rapid rate. Machines can be used as heavy-duty vertical millers, perhaps to face-mill mold blocks, when not duplicating. Large mold, used to make plastic mannequin forms, has maximum cavity dimensions of 23 in. by 16 in. and was cut from a mold block 30 in. by 21 in. by 7 in. high. Total time for this cavity was 42 hr, including setup and cutter changes

Modern methods make plastic molds . . .

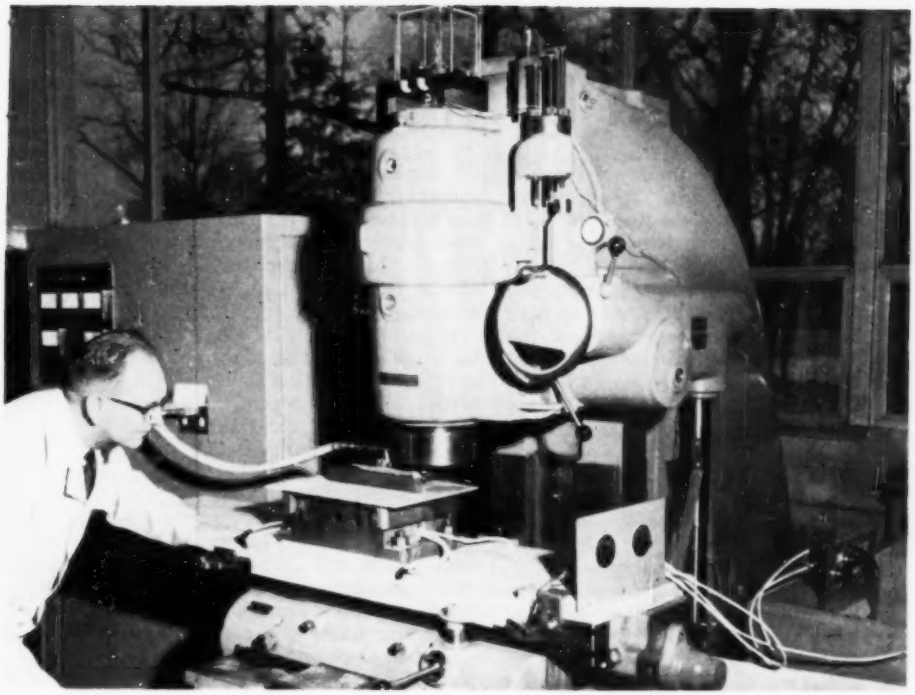


Combining all tracing functions . . .
from a common tracing stylus, the tracer used to control machining of these mannequin molds is excellently demonstrated. Job requires both depth control and 360 degree tracing, for rough and finish cuts. Combination tracer minimized the time and effort required for frequent changeover between tracing patterns

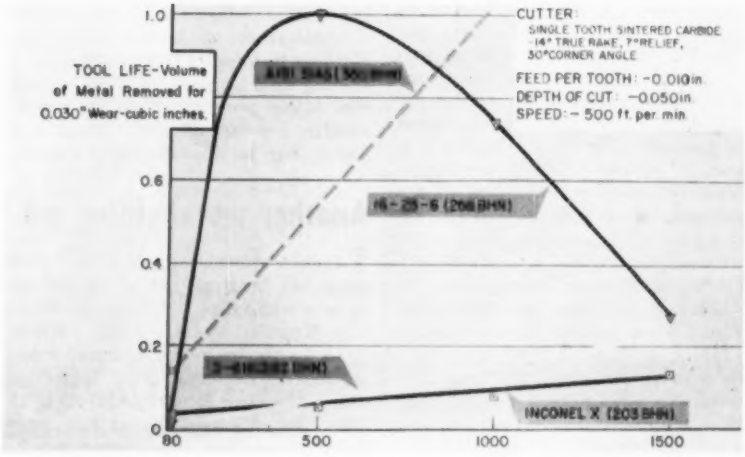


Electrical-discharge machining . . .
is making a truly significant contribution to the manufacture of molds from high-strength, heat-treated steel and tungsten-carbide molds. Still a fairly new art, full benefit from the process requires experience and skill

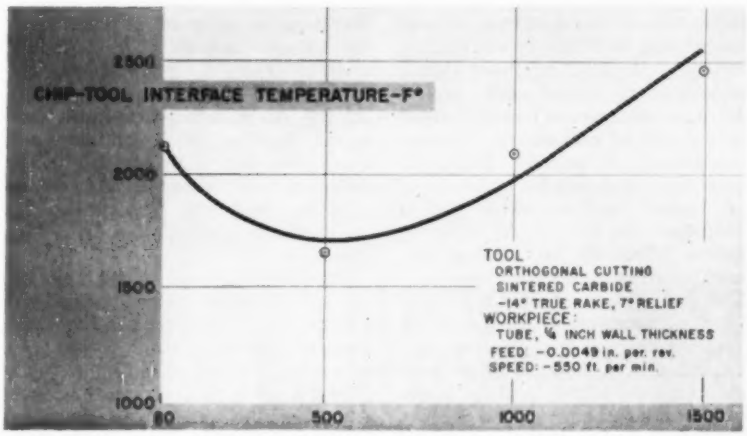
Small finished mold cavity . . .
produced by electrical discharge, together with its corresponding finishing electrode, shows die sinking capability of this process. Crankshaft forging dies have been made. Zinc-tin die castings make good electrodes for machining certain die steels; are easily able to hold tolerances of ±0.005 in. Chrome plating electrodes substantially reduces wear. Metal-removal rate and electrode wear, both under intensive study, are the two major factors limiting this machining process



Hot machining . . .
appeared to have considerable value a few years ago. Then the benefits became questionable and the technique disappeared back into the laboratories. Recently, the advent of hard, tough, "unmachinable" missile alloys brought the subject to the forefront again. In this milling setup, high-frequency induction-heating equipment is used to raise the work temperature. Gas and electrical-resistance heating also have been used



Tool life for face milling . . .
is plotted as a function of work temperature, considering only high-strength materials. Significantly, at a work temperature of 500 F, the 16-25-6 alloy (266 BHN) reaches an optimum tool life



The tool ran cooler . . .
when 16-25-6 alloy was heated to 500 F. Also, it is interesting that the minimum tool-face temperature occurred at the same value of work temperature, 500 F, as did maximum tool life. This finding provides a basic understanding for use in developing an engineering approach to "hot machining" and the selection of ideal machining temperatures for specific materials

Inert gas welding can be hazardous

By Henry Allen

There are hidden dangers involved in welding with gas-shielded arc—serious hazards to the health of the men who work with it. The danger lies in the comparative intensity of harmful radiation that inert-gas welding gives off compared with other arc welding methods. **For instance, with inert gas infra-red radiation is 1.5 times that of conventional arc welding, and ultraviolet radiation is anywhere from 5 to 30 times greater. The effect of the inert gas is to double the amount of radiation, and if consumable electrodes are employed, the effect is still greater.**

High ultraviolet radiation affects the oxygen in the atmosphere, and ozone is produced. The amount of ozone will vary with the type of gas employed, the relative humidity of the atmosphere, and the amount of current. If the flow of shielding gas is too high, the amount of ozone produced will be greater, because more radiation is transmitted to the atmosphere. And ozone concentration can become hazardous if welding is done in confined, badly ventilated areas. The solution is to control gas flow accurately with a pressure reducing regulator, and to insure adequate ventilation.

It is important to observe that the production of ozone and ultraviolet radiation—as well as metal fumes—is higher with the consumable electrode than with the tungsten electrode. Moreover, it is higher with argon than with helium; yet argon is usually preferred for welding because it provides greater arc stability at lower voltages, has greater density, and less facility for mixing with the ambient atmosphere. Ozone concentration should not exceed 0.05 ppm because above that level there is risk of pulmonary irritation to operators. A periodic check for ozone content should be made.

A second point to watch is that radiation from an arc can have an adverse effect on chlorinated solvents, causing rapid decomposition. Care must therefore be taken that, if the work has been degreased with a solvent such as tetrachlorethylene or trichlorethylene, all residues have been removed before welding. Moreover, welding should not be done in any areas where there are exposed chlorinated solvents. If arc radiation decomposes the vapor of perchlorethylene, noxious fumes are produced.

Where fluxes are employed, and the flux contains fluorides, the need for ventilation is underlined, as the flux, under heat, can create irritant fumes. The usual personnel protection for conventional welding applies also to shielded-arc welding, but it should be even more extensive, and it is sound policy to insist that operators wear protective clothing over all parts of the body exposed to infra-red and ultraviolet radiation. Wool or leather is indicated because cotton soon tends to disintegrate under ultraviolet radiation from the arc. Welding booths are essential to protect other employees in the work area, and they should be painted with a dull finish to nullify the risk of reflection.

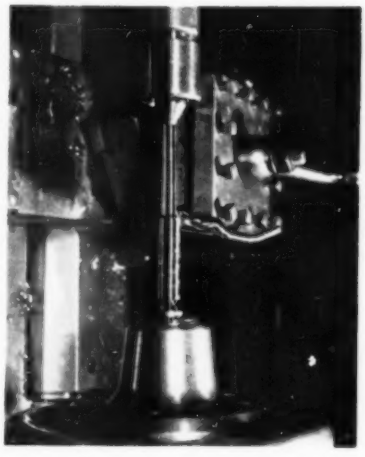
Application of inert-gas-shielded welding to some of the newer metals coming into general use has raised new safety problems. There is a possibility, for example, that gases and fumes may be liberated in the welding process and, where beryllium is concerned, any such fumes need careful control. Beryllium fumes are toxic above 2 milligrams per cubic meter of air per 8-hr shift, and this should be regarded as an absolute maximum.

If beryllium and its alloys are to be welded, the strictest precautions of local ventilation must be observed. Cadmium also needs careful blanketing. It can create a toxic hazard because cadmium oxide fumes will be generated during welding. There is, however, little or no danger from the use of thoriated tungsten electrodes, as extensive tests have shown that the air content of thoria generated in welding is perfectly innocuous and well below the maximum allowable concentration.

One other point to watch is the selection of the proper shade of the filter plate in the welding helmet which protects the operator from reflected ultraviolet light, as well as from flashes. There is a right ratio between shades and range in amperes, and that fact should be honored in the safe working code of any shop using inert-gas welding.

Another workholding job for titanium

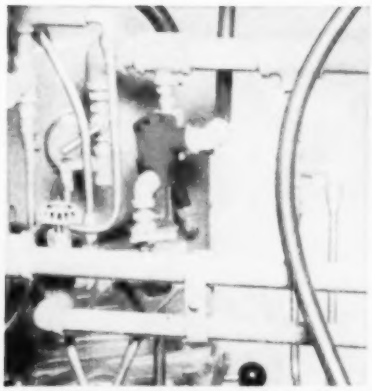
Titanium's tendency to gall and seize has been turned to advantage as a workholding material by Mallory-Sharon Metals Corp, Niles, Ohio, particularly in machining thin-sectioned non-magnetic materials (Metalworking Report, AM—Feb 23 '59). Now, Mallory-Sharon has come up with another time-saving workholder job for titanium (see photo) that is particularly useful in machining tensile coupons. The centered work is driven by a live center on one end and a titanium drive center on the other, eliminating conventional "driving dogs" and allowing a complete pass to be taken without reversing the work. In this case, only the frictional forces between the steel and the titanium drive the specimen.



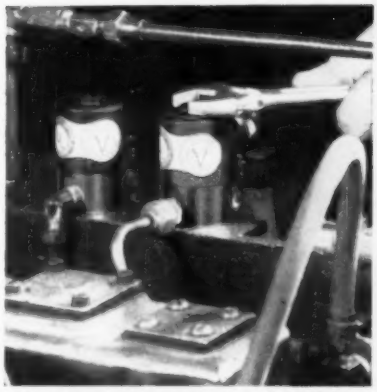
Other applications for titanium as a workholder, as suggested by Mallory-Sharon: (1) step chucks for automatic machining—a titanium vise jaw need be clamped only once, will hold the work firmly after that, and (2) in applications where vacuum chucks are now needed to hold thin-sectioned non-magnetic or even magnetic materials. Too, the problem of marring the surface of finish pieces is eliminated because a smooth titanium face may be used.

Why Skinner V5 solenoid valves are solving so many control problems

Application: The Leland-Gifford nine-unit hydraulic drilling machine used for drilling crankshafts uses two-way Skinner V5 valves to control the flow of coolant at each operating station of the fixture.

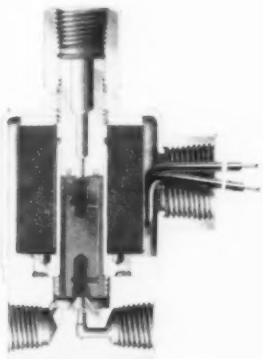


Automatic coolant operation: The Skinner V5 2-way normally closed valves are wired so that at the start of the drilling operation the valves are energized causing coolant to flow before the drill starts its drilling pass. When the cycle is complete the drill retracts, the valves are de-energized and the flow of coolant is halted.

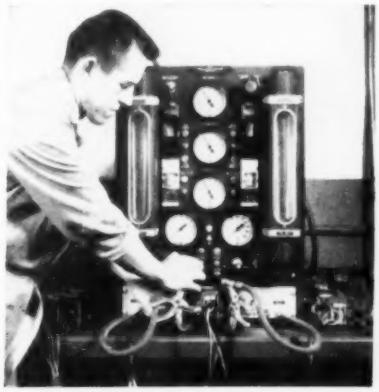


Simple maintenance and repair: The design of Skinner V5 valves permits hand disassembly for cleaning without removal of the valve from the line. Coils, housings, plungers, sleeves are interchangeable and easily replaced.

Skinner stainless steel V5 valves are offered in two- and three-way construction, normally open, normally closed, directional control, multi-directional, quick exhaust. Orifices: 1/32" to 3/8"; NPT ports: 1/8", 1/4", and 3/8"; pressure ratings: to 3000 psi. Explosionproof models UL approved for both Class I, Group D and Class 2, Groups F and G are available.



Engineered to highest UL standards: Body and internal parts of *frequently copied* V5 valve are stainless steel and, thus, corrosion-resistant. Durable, compressible inserts of soft synthetic materials insure bubbletight operation. Orifice seats have radius with well-rounded contact area and high finish for long insert life.



100% tested. Prior to shipment, every V5 valve is tested for both internal and external leakage under full pressure conditions with modern, sensitive detecting equipment. In these laboratory tests Skinner V5 valves regularly get over 20-million cycles without leakage. And these results are constantly proving out in service.

Skinner solenoid valves are distributed nationally.

For complete information, contact a Skinner Representative listed in the Yellow Pages or write us at Dept. 306

SKINNER ELECTRIC VALVES

THE CREST OF QUALITY

SKINNER

ELECTRIC VALVE DIVISION
NEW BRITAIN CONNECTICUT
105 EDGEWOOD AVENUE

Machinecraft gets .0005" tolerances with Cities Service Chillo Cutting oils!

Machinecraft, Inc., of Whitman, Massachusetts, makes a product that is surely the answer to many a textile man's fondest wish.

In place of old-style solid arbor top rolls, which often drip lubricant onto the fabric, Machinecraft has developed "the anti-friction top roll."

Operating on ball bearings, this unique invention requires almost no lubrication, therefore eliminates staining problems. In addition, it permits higher speeds of operation and produces more uniformly woven fabric.

In all of this, extremely intricate machining is required—and Cities Service Chillo Cutting Oil plays a crucial role.

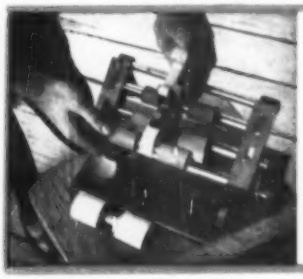
Using Cities Service Chillo "A," Machinecraft is actually achieving tolerances as fine as .0005"! Moreover, Machinecraft reports that Chillo "A" gives "excellent tool life, produces a fine finish, has unusual stability, and offers continuous quality from batch to batch."

"In addition," continues this well known firm, "Cities Service provides us with exceptional technical assistance and good delivery service."

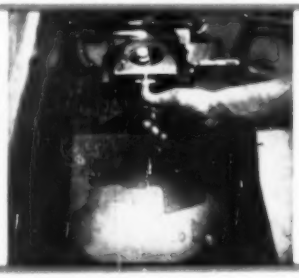
There's little to add to what Machinecraft says except a reminder that *you* can expect similar results with Cities Service, too. Talk with a lubrication engineer from the nearest office. Or write: Cities Service Oil Company, Sixty Wall Tower, New York 5, N. Y.

CITIES SERVICE

QUALITY PETROLEUM PRODUCTS



Machinecraft's Anti-Friction Top Roll is rapidly replacing old-style solid arbor type top rolls in textile mills. It prevents staining, permits greater operating speeds.



Shadowgraph is method of checking accuracy of precision machined parts for anti-friction top roll. Machine magnifies and projects the part's shadow outline. Tolerances are as fine as .0005".

American Machinist
REFERENCE BOOK SHEET

Blank Diameters for Round Shells—IV

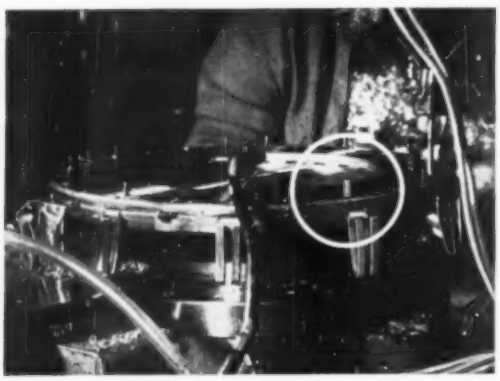
By Ferenc Kuchta, mechanical engineer J Wiss & Sons Co, Newark, N J

Workpiece	Blank diameter D	Workpiece	Blank diameter D
37	$1.414\sqrt{d_1^2+f(d_1+d_2)}$	44	$\sqrt{d_1^2+4h^2+(d_2^2-d_1^2)}$
38	$\sqrt{2d_1^2+4d_xf}$	45	$\sqrt{d_1^2+4h^2+2f(d_1+d_2)}$
39	$\sqrt{2d_1^2+4(d_1h+d_xf)}$	46	$\sqrt{d_1^2+2\pi Rd_1+8R^2}$ $\sqrt{d_2^2+2.28\pi d_2-0.56R^2}$
40	$1.414\sqrt{d_1^2+2d_1h+f(d_1+d_2)}$	47	$\sqrt{d_1^2+2\pi Rd_1+8R^2+d_3^2-d_2^2}$ $\sqrt{d_3^2+2.28Rd_2-0.56R^2}$
41	$\sqrt{d_1^2+4\left[h_1^2+d_1h_2+\frac{f}{2}(d_1+d_2)\right]}$	48	$\sqrt{d_1^2+2\pi Rd_1+8R^2+4d_2h+d_3^2-d_2^2}$ $\sqrt{d_3^2+4d_2(0.57R+h)-0.56R^2}$
42	$\sqrt{d^2+4h^2}$	49	$\sqrt{d_1^2+2\pi d_sR+(d_3^2-d_2^2)}$
43	$\sqrt{d_2^2+4h^2}$	50	$\sqrt{d_1^2+2\pi Rd_1+8R^2+2f(d_2+d_3)}$ $\sqrt{d_2^2+2.28Rd_2+2f(d_2+d_3)-0.56R^2}$

Practical Tooling Tips

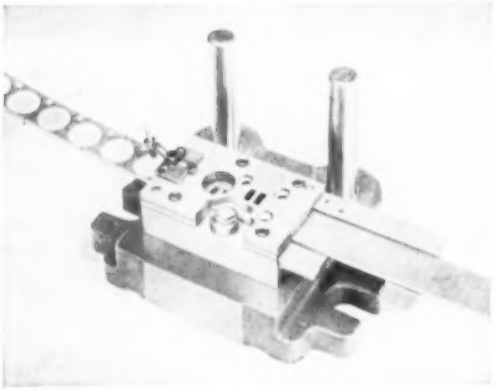
No. 3 of a series

Are your tool makers wasting time making complicated tooling gadgets when a standard, off-the-shelf Vlier part could do the job much better? Why not examine your present drawings and see where these simple, low-cost parts can be used. You will be amazed at the savings possible.

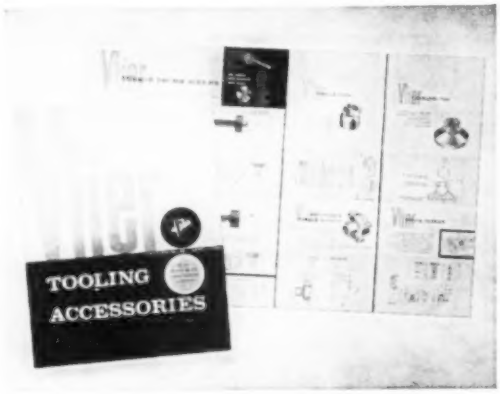


PRODUCTION INCREASED 300% when this 12-station automatic indexing and tapping fixture was put to work. Vlier Spring Plungers allow the operator to load by simply pushing the part into a slot. These simple, spring-loaded tools also position the part for the tapping operation. Available in four models; fifty sizes.

NEW SWIVEL PAD-TORQUE THUMB SCREW combines the Vlier Torque Thumb Screw and Swivel Pad Clamp. The result is a perfect holding tool—one that applies only the right amount of holding pressure without damaging the finished surface. Unique ball joint construction of the pad permits adjustment to off-angle surfaces.



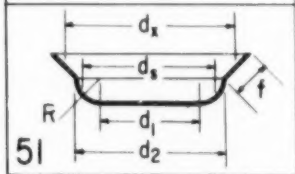
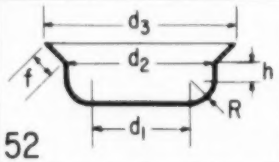
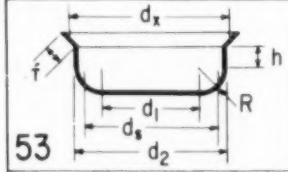
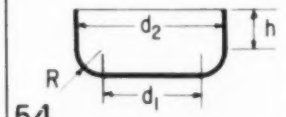
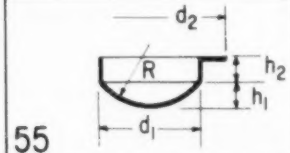
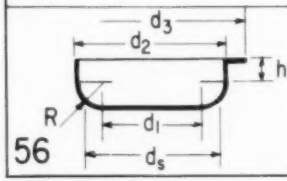
PROPER STOCK ALIGNMENT IN PROGRESSIVE DIES becomes a simple task with the new Vlier Stock Pusher. Saves pilots. Mounts in tapped hole. Accommodates stock as thin as .010"; width variations totalling $\frac{1}{16}$". Nothing to wear out or foul up.

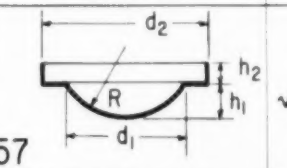
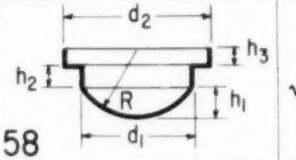
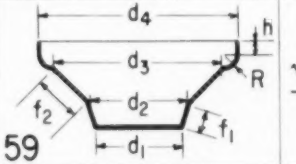
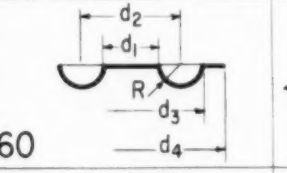
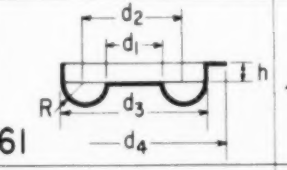
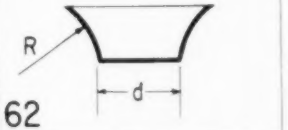


NEW 1958 CATALOG NOW AVAILABLE—Eight pages; completely revised. Includes information and specifications on all new Vlier products, including the Torque Handle, Stock Pusher, Leveling Pad. Makes ordering easy. Suggests new uses for these proven time-savers. Write for your copy today!

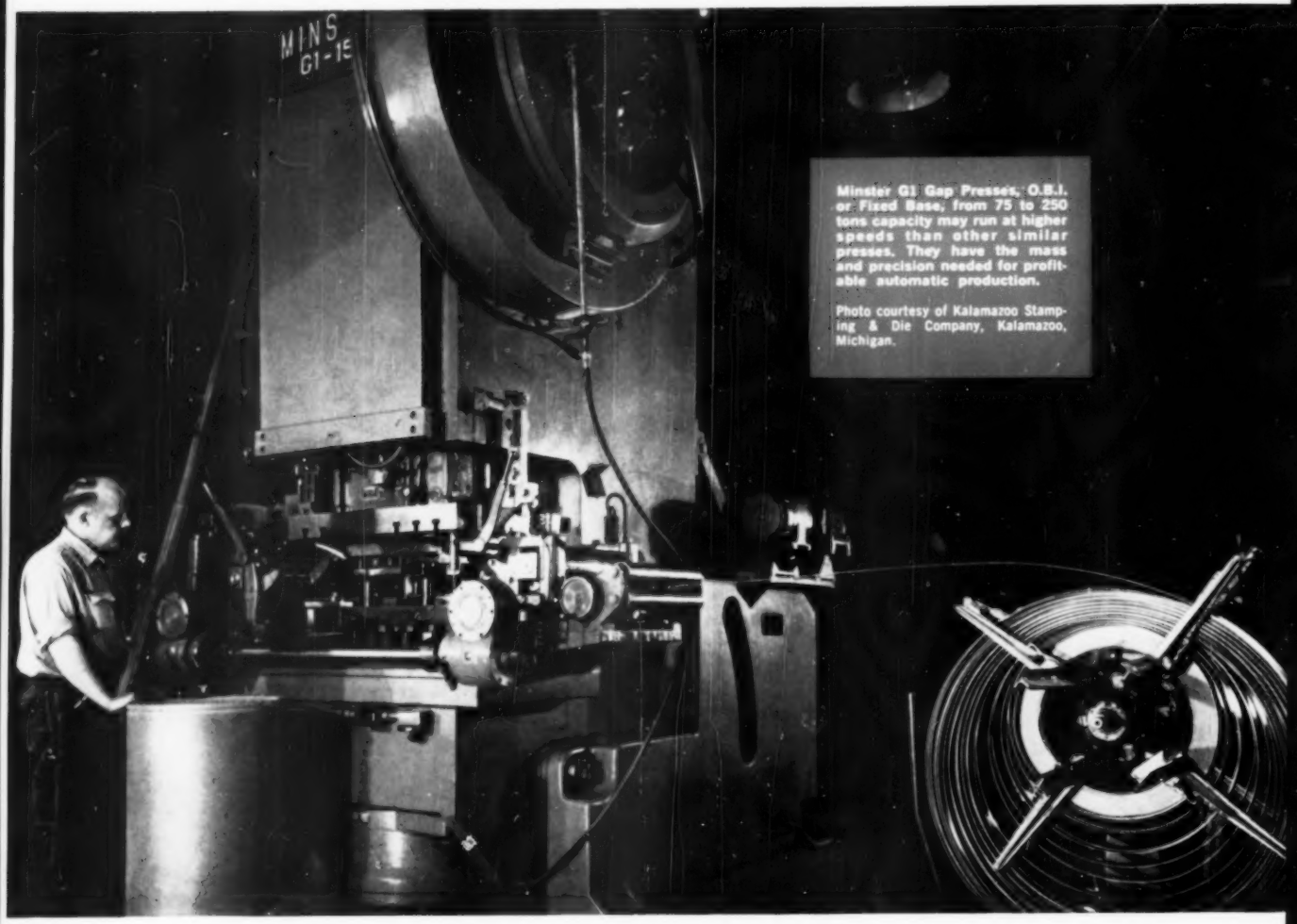
VLIER
Engineering Corporation
A subsidiary of Barry Controls, Inc.
8900 Santa Monica Blvd. • Los Angeles 46, California

Blank Diameters for Round Shells—V

Workpiece	Blank diameter D
 51	$\sqrt{d_1^2+2\pi d_s R-0.88R^2+4d_x f}$
 52	$\sqrt{d_1^2+2\pi R d_1+8R^2+4d_2 h+2f(d_2+d_3)}$ $\sqrt{d_2^2+4d_2(0.57R+h+\frac{f}{2})+2d_3 f-0.56R^2}$
 53	$\sqrt{d_1^2+2\pi d_s R+4(d_2 h+d_x f)}$
 54	$\sqrt{d_1^2+4d_2 h+2\pi R d_1+8R^2}$
 55	$\sqrt{d_1^2+4(h_1^2+d_1 h_2)+(d_2^2-d_1^2)}$
 56	$\sqrt{d_1^2+2\pi d_s R+4d_2 h+(d_3^2-d_2^2)}$

Workpiece	Blank diameter D
 57	$\sqrt{d_2^2+4(h_1^2+d_2 h_2)}$
 58	$\sqrt{d_2^2+4(h_1^2+d_1 h_2+d_2 h_3)}$
 59	$\dfrac{\sqrt{d_1^2+2f_1(d_1+d_2)+2f_2(d_2+d_3)+}}{2\pi R d_3+8R^2+4d_4 h}$
 60	$\sqrt{d_1^2+4\pi d_2 R+(d_4^2-d_3^2)}$
 61	$\sqrt{d_1^2+4\pi d_2 R+4d_3 h+(d_4^2-d_3^2)}$
 62	$\sqrt{d^2+2\pi R d+4(\pi-2)R^2}$

Eliminate expensive secondary press operations with **AUTOMATIC PRODUCTION**



Minster G1 Gap Presses, O.B.I. or Fixed Base, from 75 to 250 tons capacity may run at higher speeds than other similar presses. They have the mass and precision needed for profitable automatic production.

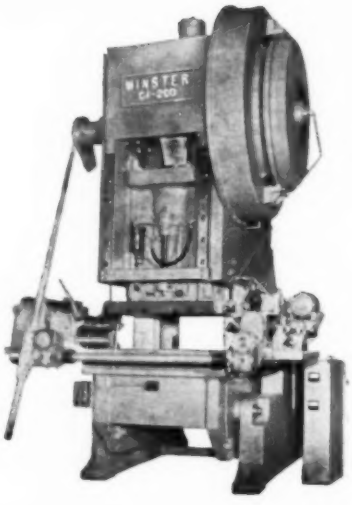
Photo courtesy of Kalamazoo Stamping & Die Company, Kalamazoo, Michigan.

Minster Heavy Capacity Gap Presses with Feeds

Progressive or compound die stamping jobs . . . long or short runs . . . are much more profitable when run automatically on the right Minster press with job-matched feed equipment.

Why pay for unnecessary rehandling of parts and storage space? Why tie up several presses when the job can be done faster and more accurately on just one press?

Minster offers a full range of presses and feeds plus technical knowledge and assistance to help you take full advantage of automatic production. Take a close look at your unit costs, then write or call . . .

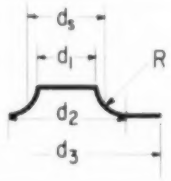
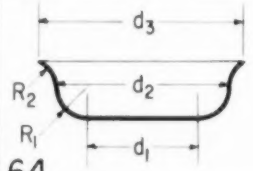
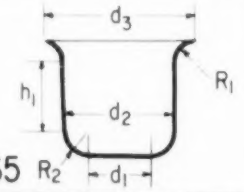
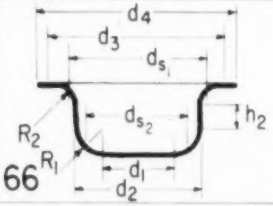
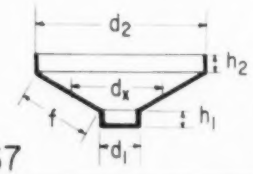


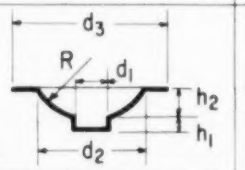
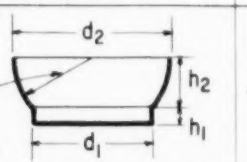
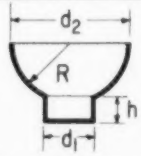
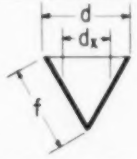
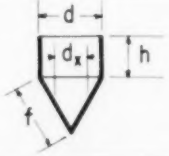
The Minster Machine Company • Minster, Ohio

MINSTER®

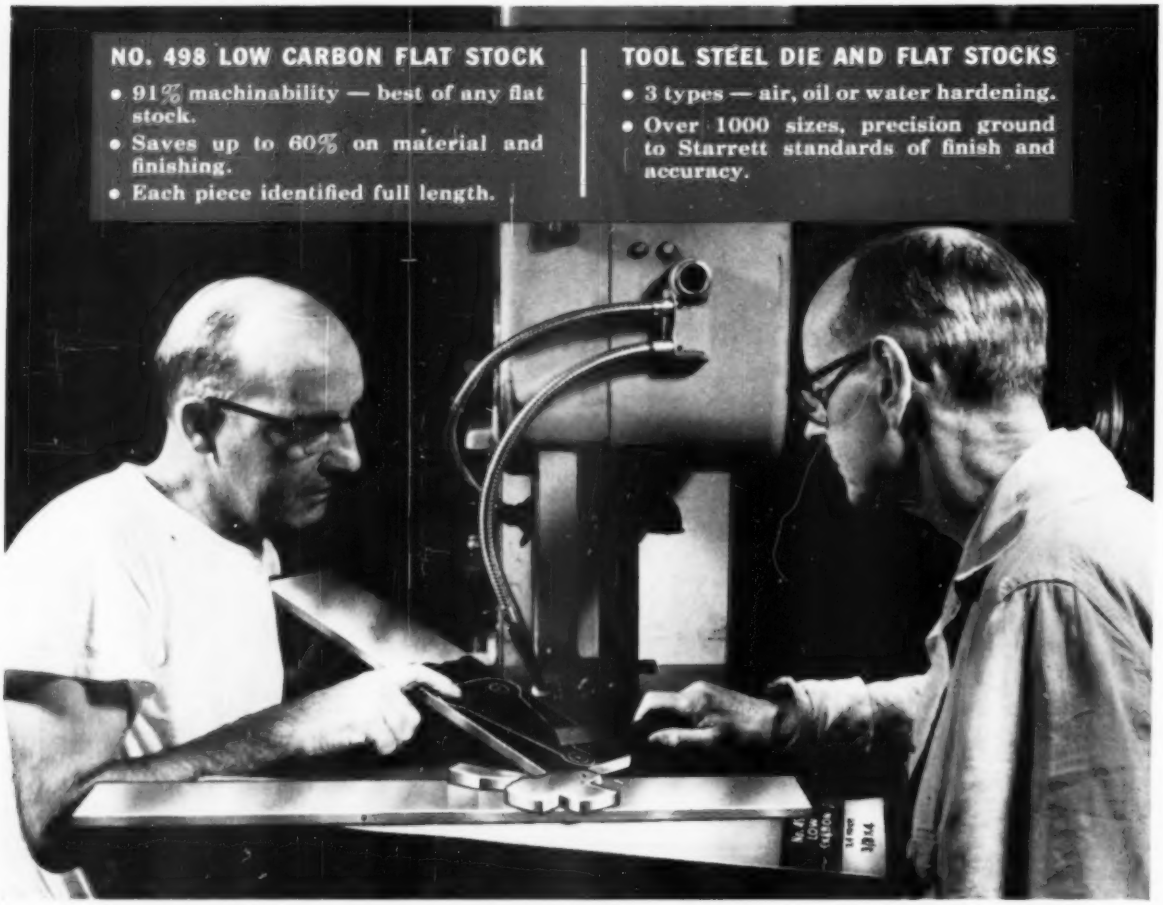
CIRCLE 239 READER SERVICE CARD

Blank Diameters for Round Shells—VI

Workpiece	Blank diameter D
63 	$\sqrt{d_1^2+2\pi d_3 R+(d_3^2-d_2^2)}$
64 	$\sqrt{d_1^2+2\pi d_1 R_1+8R_1^2+d_2 R_2+4(\pi-2)R_2^2}$
65 	$\frac{\sqrt{d_1^2+2\pi R_2 d_1+8R_2^2+4d_2 h_1+}}{2\pi R_2 d_2+4(\pi-2)R_1^2}$
66 	$\sqrt{d_1^2+2\pi d_{s_2} R_1+4d_2 h_2+2\pi d_{s_1} R_2+(d_4^2-d_3^2)}$
67 	$\sqrt{d_1^2+4(d_1 h_1+d_x f+d_2 h_2)}$

Workpiece	Blank diameter D
68 	$\sqrt{d_3^2+4(h_2^2+d_1 h_1)}$
69 	$\sqrt{d_1^2+4(d_1 h_1+d_2 h_2)}$
70 	$\sqrt{2d_2^2+4d_1 h}$
71	$2d$
72 	$\sqrt{4d_x f}$ $d_x f=\frac{d}{2}$
73 	$\sqrt{4(d_x f+dh)}$

STARRETT PRECISION MAKES GOOD PRODUCTS BETTER


NO. 498 LOW CARBON FLAT STOCK
• 91% machinability — best of any flat stock.
• Saves up to 60% on material and finishing.
• Each piece identified full length.
TOOL STEEL DIE AND FLAT STOCKS
• 3 types — air, oil or water hardening.
• Over 1000 sizes, precision ground to Starrett standards of finish and accuracy.

STARRETT Precision Ground FLAT STOCK

now available in 4 TYPES for wider use, bigger savings

The time and money-saving advantages of Starrett Flat Stock and Die Stock are now greatly extended with the introduction of new Starrett *Free Machining-Low Carbon* Flat Stock.

This new fine grained, low carbon, silicon killed steel has 91% machinability — best of any flat stock. Available in 24" lengths, $\frac{1}{16}$" to $2\frac{7}{8}$" thicknesses, $\frac{3}{8}$" to 16" widths. Can be used soft, carburized or case hardened. Each piece identified full length to avoid confusing with other steels and packaged in protective envelope.

Your nearby Industrial Supply Distributor also has Starrett tool steel Precision Ground Die and Flat Stock in three types — Air, Oil and Water Hardening. Flat stock in 18" lengths, die stock in 36" lengths — in over 1000 widths and thicknesses. Ask him for complete information or write for Bulletins 1109 and 1110. Address Dept. C. The L. S. Starrett Company, Athol, Massachusetts, U. S. A.

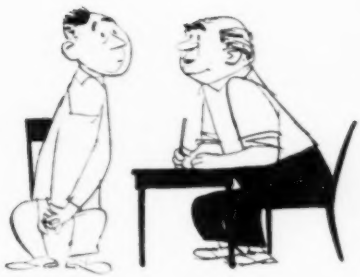
Starrett®

FLAT STOCK and DIE STOCK

World's Greatest Toolmakers

PRECISION TOOLS • DIAL INDICATORS • STEEL TAPES • GROUND FLAT STOCK • HACKSAWS • HOLE SAWS • BAND SAWS • BAND KNIVES

Talking Shop...



Bright People

"I MADE IT a rule never to hire a man that wasn't brighter than I," said the retired president of a large manufacturing company, according to a story relayed to us by a man from Rogers, Slade & Hill. The trouble with dumbbells, he said, is that you spend so much time telling them what to do that you could do the job quicker yourself—and if you aren't careful you will. This is good advice, but the brightest man of all is undoubtedly the man who practices it and lets other men show their best —even if it makes them seem brighter than he.

Didn't Turn Green?

SKIN DIVERS recently recovered an Ashcroft torpedo tube pressure gage from the hull of a submarine sunk (in a test) in 1919 in the waters off Waterford, Conn. After 40 years under water, not a part of the gage was damaged or corroded. The gage was origially designed by Edward H Ashcroft, but the 1919 model was made by Manning, Maxwell & Moore, using bronze for the working parts and brass for the case.

$12,500 Heat

REMEMBER those steel pennies in World War II? Recently a million and a quarter of them were charged into an open-hearth furnace in Pennsylvania. The coins that made up the $12,500 heat of steel had been withdrawn from circulation by the Treasury and delivered in sealed metal containers for melting down as scrap.

Laminated Quality

RECENTLY WE LEARNED a good deal about the making of laminated plastics for printed circuits in a long conversation with John Currier, president of New England Laminates. John told us that much of the trouble with laminates arises because users fail to recognize that there is as much difference in grades of laminate as there is in grades of steel. A laminator can make up almost any desired quality of board, but the plant that is going to use the board too often orders without making clear the performance that will be required and so gets a cheap laminate that turns out to be a poor economy.

Simplicity Plea

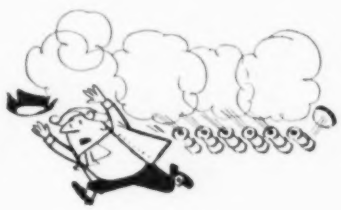
THE SIMPLEST WAY to do a job is always the best. One of the advantages of a limited budget is that it sometimes forces simplicity. Otis Elevator recently reviewed the history of the Washington Monument (inspired by its installation of a new elevator in the shaft) and reminds us that it was a lack of funds that eliminated the elaborate circular base of the monument with columns and statues and forced the construction of a simple, impressive granite shaft.

A similar shortage of funds in building the George Washington Bridge left the towers unfinished and created the exposed structural framework that has become so famous.

While we don't advocate shortages of funds, and we've often found that it takes a lot of money and effort to create simplicity, our basic point is that in tooling a shop job, as in building a monument or a bridge, the simpler you can make it the better.

MEMOS

by BESS RITTER



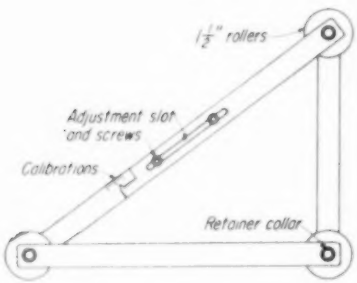
Among Benjamin Franklin's lesser-known inventions is an alarm clock described in his Poor Richard's Almanac of 1757 —a sundial which strikes the hour with the help of 32-pound cannon. There is one cannon at the one o'clock mark; two cannon at the two o'clock mark; three cannon at the three o'clock mark, and so on. Magnifying lenses are placed to ignite the powder of each cannon at the proper time.

This was evidently dreamed up by Franklin as a gag, because he points out that "this kind of dial . . . would be very expensive, and the cost greater than the advantage"; however, many projects "are like this striking dial, great cost for little profit."

A sequel to the lighting-rod invention of Benjamin Franklin: The practical device was accepted in England as well as in America, but patriotism in both countries was so high at this time that Englishmen and Americans took sides as to which type of lighting rod was most practical. The English type had rounded conductors. The American type had points. King George III insisted that the rounded English type was by far the best, installed this type on the roofs of Kew Palace, and insisted that the President of the Royal Society agree with his "scientific" conclusions.

Sir John Pringle could only honestly reply that "the laws of nature" just couldn't be changed "at royal pleasure." This cost the man his forced resignation from the Society, and in addition, he was relieved of his position as George III's personal doctor.

Practical Ideas . . .



Adjustable Square Facilitates Inspection and Erection Work

While we recently were in the process of constructing large weldments, a means of checking their squareness within allowable tolerances became necessary. We therefore constructed the adjustable square shown. This, with its three points of contact, gives us out-of-squareness readings in 1/64 in. per ft. These readings can also be calibrated in degrees-per-foot if so desired.

Because our work was large, we required a relatively large square. Its dimensions were made in the ratio of 3 to 4 to 5, or 18 in. by 24 in. by 30 in. But other sizes, larger or smaller, can be made with equal accuracy and satisfaction.

The vertical and horizontal legs were accurately drilled and reamed at 24 in. and 18 in. center-to-center distances respectively to receive ¼-in. dowel pins used to join them with 1½-in. diameter by 3/16 thick rollers. Small collars with setscrews retain the dowels. The 30-in. leg was made in two sections joined by two screws which operate in a slot to provide the adjustment.

A pointer was formed on the slotted section, and calibrations were marked after having been found by the following method: Location for the zero mark was found by placing the rollers on the 18-in. leg against the blade of a master square while the beam of the master and the rollers on the 24-in. leg rest on a surface plate.

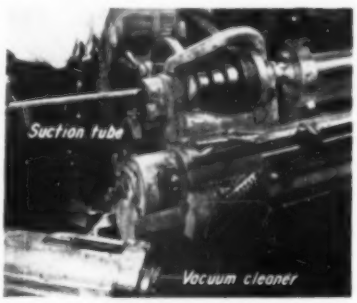
Additional graduations, indicating less than 90° angle, were arrived at by placing 1/32-in. shims under the outer roller on the 24-in. leg. More than 90° – angle markings were made after placing the same shims under the roller next to the master square.

Ernest Jones, Bronx, NY

Household Vacuum Cleaner Solves Graphite-Dust Problem

One shop which produces molds, tools, and crucibles of graphite has found a household vacuum cleaner an important tool. The big problem was that during the various machining operations, the cuttings would crumble into a black powder which enveloped the operator and obscured his work. Dust and chip accumulated in a bore would also clog the boring tool and damage the workpiece.

To solve the problem, vacuum cleaners have been rigged up to



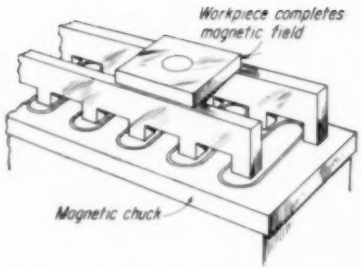
either direct the dust toward an exhaust fan, or to draw it into the cleaner bag. In turning, drilling, or sawing, the nozzle is placed close to the cutting tool, but during a boring operation the nozzle is held by an adjustable stand at the back end of the spindle. Because both stand and vacuum cleaner are portable, they can quickly be moved to work at any machine.

Even under this rough usage in graphite machining, the vacuum-cleaner motors last 2 to 3 years before the dust entering the motors shorts them out. Masking tape covering the switches protects them against the shorting effect of the dust.

Harry J Miller, Sarasota, Fla

Efficient Magnetic Parallels Made from Bar Stock

Surface grinding odd-shape parts sometimes makes it necessary to raise the work from the face of the chuck. The use of magnet-conducting parallels is then the logical solution, and commercially available laminated parallels do a fine job. But there may be times when even these fall short.



A good substitute can be made in a matter of minutes from material often on hand. We make parallels like those shown of CR steel in thicknesses ranging from ¾ to 1¼ in. The size of the work will determine their height as well as their length, but for all practical purposes, they can be as long as the chuck.

After the material for the parallels has been selected, ports are laid out and cut in the bottom edges. This is to create feet which on one parallel will touch only the inner poles of the chuck, while the other parallel is made to contact only the outer poles. The feet are then given a clean-up grind, after which the parallels are turned over and ground on top.

With the parallels in their respective positions, the magnetic field is completed when a flat burr-free piece is placed across the tops and the magnetic chuck turned on.

Hugh Monaghan, Bronx, NY

Colander Separates Mixed Ball-Bearing Balls

Through carelessness 3/16 and 5/32-in. diameter steel balls became mixed causing a stoppage of our ball-retainer production. Several methods to separate the mixture were tried, but discarded because they were all too slow.

I found a simple solution to the problem in using an ordinary kitchen colander to separate the smaller balls from the larger. Armed with a handful of the mixed balls, I went to a nearby household supply store and purchased a colander having holes that would only allow the 5/32-in. balls to pass through.

The uniformity of the hole tolerance was surprising, and, without much ado, the balls were quickly separated.

Fred Lettino, Long Island City, NY

Cup Blanked, Pierced, and Drawn in One Operation

Simplicity of design with the maximum efficiency was the goal set for the die which was to produce the cup shown in Fig 1. These requirements were filled by the die illustrated, which blanks out the material for the cup, draws it into a hemispherical shape with a step rim, and pierces a hole, all with one stroke of the press.

Strip stock is fed from the right into a channel on the face of the blanking die and registers against a stop button. The blanking-drawing punch cuts the blank and then draws it over the hemispherical drawing die. Blank-holding pressure is provided by the combined blank holder and ejector ring.

A ⅛-in. hole is pierced on top center of the shell by a punch fastened in the spring-loaded punch ejector. The piercing takes place approximately 7/64 in. before the shell is finished drawn. As a result, the hole will be a trifle enlarged because of the metal stretching after the hole is pierced. This eliminates the need for the shell to be stripped from the piercing punch.

On the upstroke of the press the shell is ejected from the drawing punch by the spring-loaded ejector carrying the piercing punch. After the shell has been stripped off the drawing die by the ejector ring, which is activated by an air cylinder, air is used to blow it from the die.

Hjalmar Dahl, Upplands Vasby, Sweden

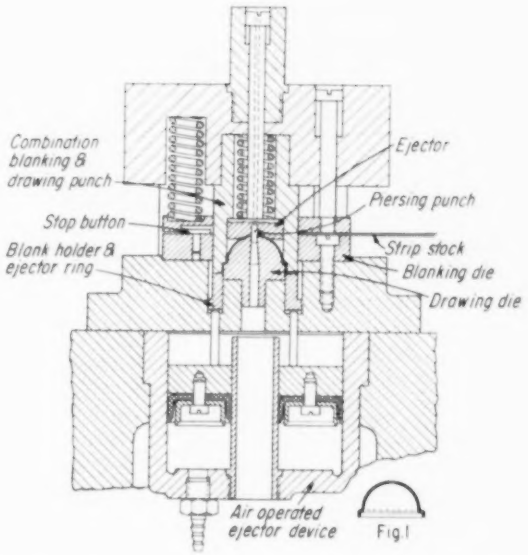
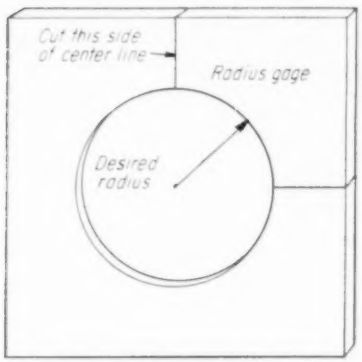


Fig 1



Some Radius Problems Solved

When a radius must be laid out on a piece that cannot be punch marked for use of dividers, a drill gage will serve as a radius templet. The great selection of radii a fractional-drill gage provides is especially useful where a radius tangent to two lines has to be laid out.

Because drill gages are hardened, there is no danger of wear when scribing through the holes.

An off-standard radius gage is sometimes necessary for checking work of various types. To make one of these, simply select a piece of 1/16 to ⅛-in. ground stock, square it up and bore a hole in its center with the required radius. A quarter section is then sawed out to form a convenient quarter-radius gage.

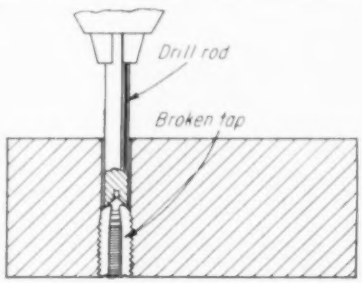
If accurate reference edges will be required, the edges of the piece should be squared up by grinding before the hole is bored or ground. Also, when making the saw cuts, allowances should be made to finish the butt ends by grinding to the center lines. Should the gage be used primarily as a sight gage, and if it is made of heavy material, a sharp bevel can be machined on one side of the radius (before sawing) to produce a thin edge.

Howard Levy, Brooklyn, NY

Rod Removes Broken Tap

It is never a pleasant task to remove a broken tap, but the job can be made much easier when the illustrated method is used. The only limitation this method has is that it applies only to work with through holes. For that reason we make it a practice to drill our holes completely through the workpiece whenever possible.

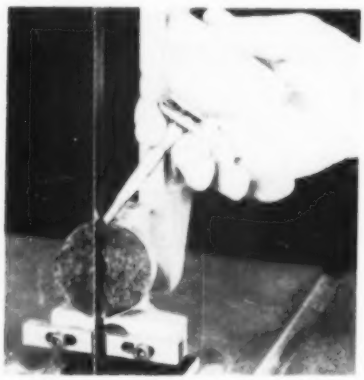
When a tap has, unfortunately, been broken, we proceed in the following manner: All fragments are first cleaned away from the broken end to prevent their jamming the solid piece. A piece of drill rod is then turned to about 0.010 in. under the diameter of the tap-drill size hole, after which it is centerdrilled to relieve its center.



To imprint drivers on the end of the soft rod, the cupped end is driven against the point of the tap with a series of light hammer blows. Following this, the end can be hardened, though in most cases this won't be necessary. With the rod gripped in a drillpress chuck, the driver is brought into firm contact with the tap, and the spindle is rotated clockwise by hand to back the tap out.

Jack A McIntyre, Elmira, NY

Practical Ideas...

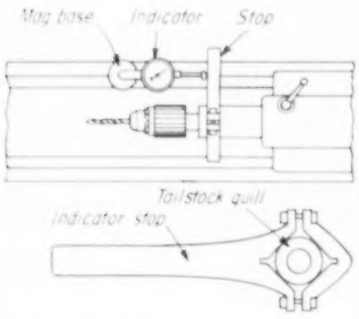


Felt Pad Lubricates Saw Blade

I have installed a simple but effective blade lubricator on my small metal-cutting bandsaw. It consists of a small can which has been slotted and secured to the guide support directly behind the blade. A felt pad is then fitted into the can so that the back of the blade will depress the felt about ⅛ in.

Periodic applications of light oil saturate the felt enough to provide ample lubrication which the blade carries into the work. I find that one application of oil is usually sufficient for the average small job. Straight kerosene or a 50/50 mixture of kerosene and light oil seems to work best when sawing aluminum.

H J Gerber, Stillwater, Okla



Tailstock Indicator Stop

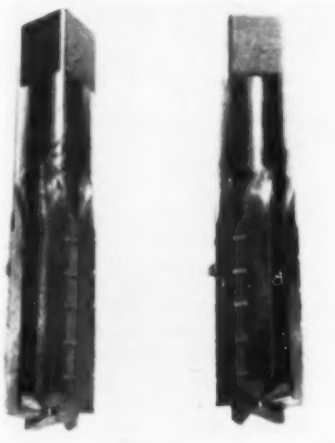
We do a great deal of precision drilling, reaming, and counterboring in the lathe. Then, not only must the hole diameters be held to close tolerances, but the depth of the holes and counterbores are just as critical.

To simplify depth control and eliminate guess work, since these operations are performed with the tailstock having no accurate graduations, we devised the tailstock stop shown. It clamps onto the quill to provide a striking surface for a dial indicator.

The indicator, which is mounted on the back way of the lathe via a magnetic base, is a standard dial job with a ½ to 1-in. travel. It is set and zeroed out with the aid of gage blocks or adjustable parallels once the tool contacts the work.

Aluminum ½ to ¾ in. thick is used to saw out the stop as shown in the lower part of the sketch. Facing V's are used in this design because the stop can then be applied to quills of different diameters. If, however, the stop will be used on one lathe only, a hole to suit the diameter of the quill can be bored. One slit into the bore and a screw across the slit is all that is needed for clamping.

R B Courtney, Whittier, Calif



Emergency End Mills Made from Discarded Taps

Recently a lack of the proper-size end mills was responsible for the creation of the mills shown. Both were ground down to the size required from taps salvaged from the scrap box.

The taps selected were 1¼ in. NF hand taps, one right and one left hand. Both were ground down to 1 1/16 in. diameter, after which each flute was relieved and provided with chip breakers as shown.

These tap mills did an excellent job opening T-slots in large cast-iron bed plates, cutting two slots per pass.

J M Askins, Lufkin, Texas

Arnold Koch
Milton, Ontario, Canada

$25 In addition to regular payment for his idea:

VISE-JAW INSERT HOLDS WORK

in the April 20, 1959 issue

An extra $25 will be paid for the best Practical Idea in each issue of *American Machinist*. Selection of the winner is made by a group of our readers.

PAYMENT—$25 in addition to regular rates for the items published to be paid as soon as reader votes are received—usually three to four weeks after the date of issue. The winner will also be announced in these pages as soon thereafter as practicable.

JUDGES—A group of 200 *American Machinist* readers in asked to select preferred articles in each issue. The group is a true cross-section of all readers, and changes entirely each time. Their votes, in addition to guiding the editors, select the best Practical Idea. If at any time their votes result in a tie, $25 will be paid to each co-winner. Decision of the readers will be final in each case.

REQUIREMENTS—Only items in the Practical Ideas pages are eligible, and they must be submitted directly by the originator. Do not worry about your shortcomings as a draftsman, photographer, or author—every item will be edited in accordance with *American Machinist* standards and suitable illustrative or explanatory material added where needed. Readers will judge only the finished product—in terms of its usefulness to them.

WHO MAY ENTER — Anyone may enter except employees of the McGraw-Hill Publishing Co, Inc, and those of advertising agencies or departments. Suggest to your employees that they submit ideas.

HOW TO ENTER — Send all entries to "Practical Ideas Editor," American Machinist, 330 West 42nd St, New York 36, N.Y.

New Shop Equipment
Materials and Parts

Numerically-Controlled Turning-Boring Machine Holds 0.0001-inch Tolerances

Model S Bore-Matic numerically-controlled, double-spindle turning and boring machine will machine inside and outside contours of hemispheres, cylinders, and other metal parts with infinite variations of a hemispherical contour to a repeatable tolerance of ±0.0001-in. The single-point, two-axis machine tool system was designed and built cooperatively by the Heald Machine Co and the Industrial Controls Section of Bendix Aviation Corp.

In operation, the workpiece is clamped in a rotating fixture attached to the spindle. One spindle machines the OD and the other spindle machines the ID, but only one spindle at a time is operated. The numerical control system provides a command pulse value to each of the two machine slides of 0.000025-in. or 40,000 pulses per inch of slide travel. According to the manufacturers, in many instances it is possible to achieve tolerances of ± 0.000070 in.

The machine has a 14-in. maximum swing and can accommodate parts up to 18-in. long. The two spindle heads are driven by a variable speed ac motor drive unit which provides constant surface cutting speed over a 5:1 ratio. Spindle speed can be varied from 50 to 1500 rpm by changing sheaves and drive arrangements. Table travel is 20 in. and cross-slide travel is 15 in. The top of the table slide and base of the cross-slide are integral. Precision gib adjustment allows accurate tracking over full slide travel within 0.000025 in. Stick slip friction is 1.3 to 1. Base weldment is normalized and slide ways are hardened and ground steel bars. A bridge mounted on the base holds two heads with a spindle runout of 0.000020 in.

This numerical control system is said to provide an extremely versatile method of machining any number of different parts shaped with only one machine tool. In addition, it is claimed that this system reduces tooling costs, increases production, and shortens the manufacturing cycle.

Heald Machinery Co, Worcester, Mass, and Industrial Controls Section, Bendix Aviation Corp, Detroit, Mich

MORE DATA? Circle 51, inside back cover.

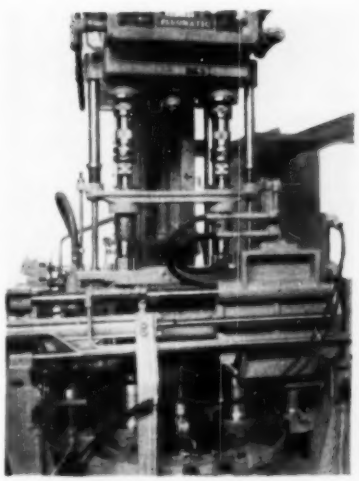
Nuclear Thickness Gage Features Ultrasensitivity

Ultrasensitive nuclear thickness gage, Model 42000, measures material thickness to two millionths without contacting material; measures thickness of protective coatings and impregnations to within 0.01% of total material thickness; measures changes in basis unit weight of 0.005 mg per sq cm.

Material to be measured, such as extrusion or sheet, flows past a small radioactive source. Gage on opposite side detects changes in strength of radiation due to changes in material thickness. Single electronic control unit permits detection at two points. Continuously variable time response ranges from ¼ to 30 seconds.

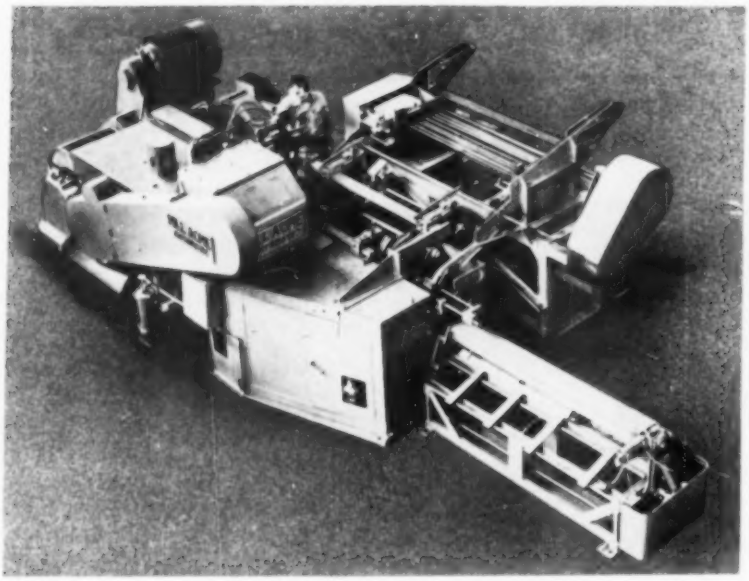
Radiation Counter Laboratories, Inc, Nucleonic Park, Skokie, Ill

MORE DATA? Circle 52, inside back cover.



VERTICAL HONING MACHINE automatically hones 144 cylinder sleeves per hour at 80% efficiency. It removes 0.002 to 0.004-in. of stock to accuracies of 0.0005 in. roundness and 0.0007 in. bore and taper sizes. The two-spindle reciprocating head includes electronic hone expansion and automatic bore-to-bore sizing—*Barnes Drill Co, 830 Chestnut St, Rockford, Ill*

MORE DATA? Circle 53, inside back cover.



Hill Acme Introduces Automatic Forging Machine With Integral Induction Heater

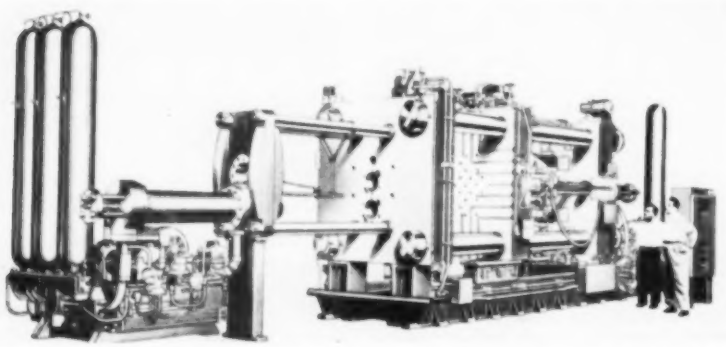
A fully automatic forging machine, integrated with an induction heater, has been developed by Hill Acme in capacities of 1¼ to 5 in. The design of this forging unit does not limit the number of die positions or the length of stock to be used in forging a variety of parts.

The machine illustrated is used to produce ⅝ and ¾-in. mine roof bolts from 12 to 72-in. long at the rate of 45 pieces per minute. Pieces longer than 36 in. are supported through the various passes by a walking beam.

The rods, already threaded at one end, are loaded into the feeding rack where a chain-driven index feed positions them for proper spacing through the induction furnace. As the rod ends are heated they are delivered, at the proper timing cycle, to the forging machine by a roller chain feed. Here they are gaged for length, picked up by fingers and passed progressively through the four-position die. The finished forgings are discharged from the back of the machine by a separately driven conveyor, arranged for both right and left-hand discharge.

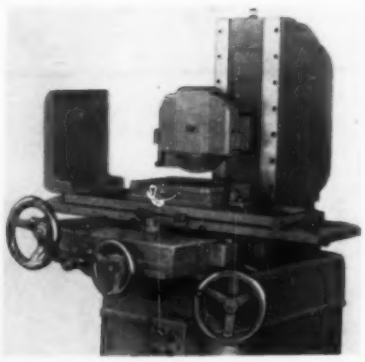
Hill Acme Co, 1201 W 65th St, Cleveland 2, Ohio

MORE DATA? Circle 54, inside back cover



2000-TON DIE CASTING MACHINE, largest in company's line of standard size cold chamber machines, is designed to produce 85-lb aluminum castings of automobile door frames, motor blocks, or housings. Platens measure 18 x 80 x 80 in., tierods 11 in. Die stroke is 22 in. min to 36 in. max. Injection cylinder stroke is 30 in. min to 44 in. max—*Cast Master, H-P-M Div., Koehring Co., Bedford, Ohio*

MORE DATA? Circle 55, inside back cover

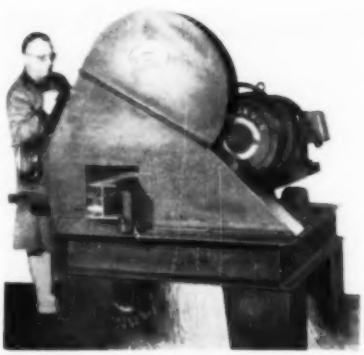


Hydraulic Surface Grinder Has 10x16-in. Work Surface

No. 17H hydraulic surface grinder has a 10x16-in. work surface and a 14-in. capacity under full 12-in. dia grinding wheel. Table speeds are infinitely variable up to 70 fpm. Cross feed is infinitely variable from 0.005 to 0.250 in., with rapid traverse for dressing the wheel from the chuck or quick positioning the work. It is equipped with a 2-hp, 1750 rpm, motor drive spindle.

Covel Mfg Co, Benton Harbor, Michigan

MORE DATA? Circle 56, inside back cover



30-hp Chopsaw Handles 8 x 8-in. Sections or Solids

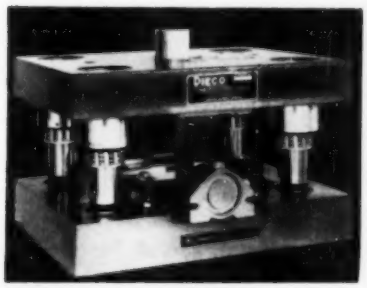
Chop or swing-type high-speed metal saw for production and maintenance work is designed for friction or abrasive cutting, and can be used with a grinding wheel. Features include more powerful main motor (30 hp); sealed-bearing spindle timing belt drive and a new dynamic suspension system that permits light fingertip feed without springs, counterweights, or adjustments.

Machine provides straight or oscillating feed at option of the operator. When oscillating button is pressed, blade moves forward and backward, in and out of the cut, in line with the

cutting plane. This reduces the arc of contact of the blade, increases blade life, and speed of cutting, and permits cleaner, generally burr-free abrasive sawing either wet or dry. Oscillating speed is variable. Heavy, one-piece shrouded blade guard protects against sparks, water spray, or metal chips. Spindle and guard provide up to 30-in. blade capacity. Screw-operated double vise is adjustable to handle up to 8 x 8-in. sections or solids. Unit is priced at less than $3000.

Ty-Sa-Man Machine Co, 1001 White Ave, Knoxville 1, Tenn

MORE DATA? Circle 57, inside back cover



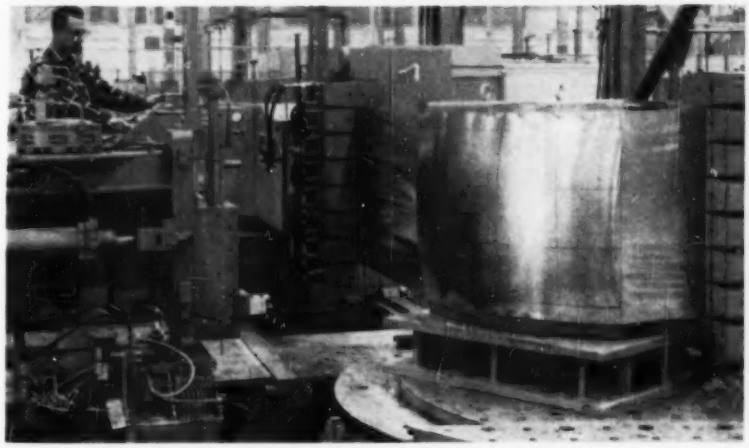
Bliss Ball Bearing Die Set Assues Positive Die Alignment

Ball bearing die set using pre-loaded ball bearing cage assemblies, is reported to assure positive alignment of punches and dies, thus eliminating blurred parts, reducing rejects, and extending the life of dies between regrinds. It is also said to be easy to assemble and disassemble and can be stripped from the die posts.

Other features are: (1) angled slots in the bearing retainer offset each ball by four degrees and prevent vertical rows of ball bearings from tracking, (2) stepped projections in the retainer prevent the sudden shock which often occurs as an entire load of ball bearings is brought into pre-load at one time, (3) more ball bearing per linear inch, (4) ball bearings are installed in the punch holder not in the die shoe, (5) adjustable locating pins in the ball bearing assembly permit the use of the same die set on presses with different strokes, (6) guide posts are standard in all respects, (7) ball bearing assemblies may be installed on existing die sets, (8) easier to clean and lubricate because retainer can be dropped by loosening a self-locking set screw.

E W Bliss Co, Die Supply Div, 1400 Brookpark Rd, Cleveland, Ohio

MORE DATA? Circle 58, inside back cover



93-Ton Radial Draw Former Stretches Stainless Steel Sheets Into Atlas Skins

This 93-ton radial draw forming machine, measuring 82-ft long and costing over $365,000, stretches thin stainless steel sheets into skins for the Atlas ICBM. Built by the Cyril Bath Co to Convair specifications, it is said to be the largest radial draw former in the US to use a hydraulically-driven turntable.

The machine can produce metal shapes in one piece that previously required welding several pieces. Locked in its hydraulically-operated jaws, a 20-ft sheet of stainless thinner than a dime can be stretched as much as 18 in. Close control of tension is made possible by electronic measurement of metallurgical changes taking place during forming.

A die for the part to be formed is mounted on the 37,000-lb turntable. One end of the metal sheet is clamped in the jaws of the gripper unit on the turntable (right). The other end is held in the jaws of the main ram stretching unit (center). While tension between jaws is maintained, the table is rotated counterclockwise, wrapping the sheet onto the die. At the same time a compression shoe (not used in the application illustrated) which is attached to the cylinder-driven holder (left) presses the metal against the die face to form the special contours required.

Cyril Bath Co, Solon, Ohio

MORE DATA? Circle 59, inside back cover

NUMERICAL CONTROL PROCESSING CENTER, said to be the most advanced in American industry, converts punched-tape information into magnetic instructions, at speeds of 4 times real time and up to 16 times faster than was previously possible. The new system, called Numericord Director, recently went into operation at North American Aviation—*Developed by Concord Control, Inc, Boston Mass, for Giddings and Lewis Machine Tool Co., Fond du Lac, Wis*

MORE DATA? Circle 60, inside back cover

Centerless Internal Grinding Machine Grinds 0.040-inch ID Bearing Races

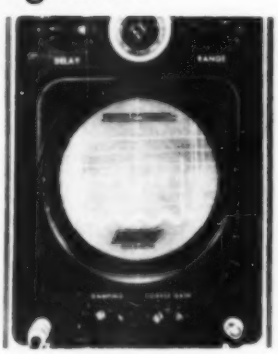
Centerless internal grinding machine grinds inner races of bearings as small as 0.040-in. to 0.00015-in. tolerance and 5 microinch finish in a fully automated 15-second cycle. Workhandling capacity of the Model 090 Centri-Matic is 0.050-in. practical minimum OD of work. Estimated bore grinding cost is $.027 per race at a total operating cost of $7.50 per hour.

The part to be ground is rotated with its ID held in contact with hard shoes against a rotating plate, which assures squareness of ground bore to face. A high speed grinding wheel reciprocates back and forth and feeds into the work to remove the right amount of metal.

Design features include: incorporation of shoe-type centerless workholding; rotation of the part from both front and rear through a unique design of the workhead; a series of wheelheads capable of operating continuously at speeds higher than comparable equipment; a hydrostatic anti-friction feeding cross slide arrangement for electronic control; a sensitized method for automatically maintaining precise wheel-to-diamond relationship and compensating for drift. Also incorporated into the machine are automatic loading, part sizing and ejection, and simplified tooling.

Heald Machine Co, 9 New Bond St, Worcester 6, Mass

MORE DATA? Circle 61, inside back cover



Ultrasonic Flaw Detector Costs $2750, Weighs 35 lbs

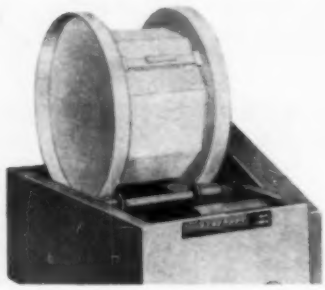
Sonoray Model 5 ultrasonic test instrument, which uses the pulse-echo principle for flaw detection and thickness measurement, costs $2750, weighs 35 lbs, and has an operating range of 0.4 to 10 mc. It is said to offer simplified operation, portability for field testing, and flexibility for laboratory requirements.

Ultrasonic pulses are sent intermittently into the material under test and, together with the returning echo, are displayed on a cathode-ray tube. Variations in the normal pattern indicate a flaw or discontinuity.

The Sonoray automatically adjusts to any transducer within its operating range. Quick disconnects on the transducers enable the frequency to be changed in 5 seconds. Instead of a square distance marker, the instrument shows a pyramid, which is said to make it easier to detect signals that are weak or are at critical points. An optional plug-in flaw alarm will activate bells or other devices to signal that allowable test limits have been exceeded. It operates on 110-v, 60-c current, and draws 160 w. Dimensions are 11-in. high, 7⅝-in. wide, 20¼-in. deep.

Branson Ultrasonic Corp, 40 Brown House Rd, Stamford, Conn

MORE DATA? Circle 62, inside back cover



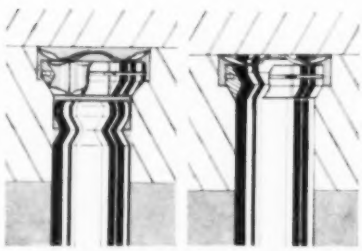
Portable Finishing Barrel Handles Small Lots of Parts

Model DBM-10 Super Mite portable deburring and finishing barrel is especially intended for use in plants and departments processing small lots of parts. It will handle close tolerance radiuses and low microinch surface finishing.

The 12-in. dia barrel has a ½ cu ft capacity and is equipped with a quick-acting cam type door. It is driven at speeds variable from 19 to 38 rpm by a 1/6-hp, 110-v motor. The entire unit measures 26-in. high by 30-in. long by 18-in. wide. Weight is 96 lbs.

Almco, Queen Products Div, King-Seeley Corp, Albert Lea, Minn

MORE DATA? Circle 63, inside back cover



New Type Retainer for Removable Punches Said to Cut Die Costs

The Cone Lock punch retainer, used with an angular shoulder removable punch, is said to cut die manufacturing costs by 20% and die maintenance costs by 70%. According to the

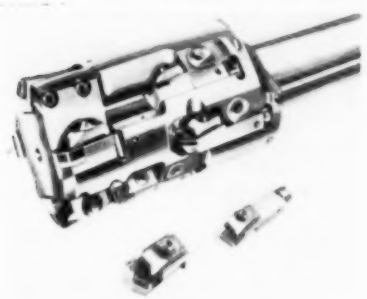
manufacturer, the unique design feature of the retainer is that it requires no built-in devices such as ball seats to hold the punch.

First, the top of each hole that retains a punch is countersunk. The Cone Lock is seated in this countersunk area and a washer type spring is placed on top of it. This provides the holding mechanism. A hardened back up plate is then mounted between the retainer and the die shoe. When the punch is pushed in, the cone lock snaps over the angular shoulder and seats it firmly. The punch can be removed by simply turning while pulling downward.

The retainer is made of a tough machinable alloy in a hardness range of 35-40 Rockwell C and requires no further hardening. It can be manufactured in any tool room, according to the manufacturer. The design of the punch used in the Cone lock retainer offers as much strength and holding power as a head or shoulder type punch.

Pivot Punch and Die Corp, North Tonawanda, NY

MORE DATA? Circle 64, inside back cover



Throwaway Inserts Used in Complex Multi-Point Tooling

A new method called the VBU system of tooling makes it possible to use throwaway inserts in complex multi-point and multi-diameter tooling. Illustrated is a typical VBU tool which roughs, semi-finish bores, and chamfers. Insert holding cartridges are mounted into the cutter body on hardened steel rest buttons to a close tolerance with the axis of the tool.

Accumulated tolerances in body, cartridge, and inserts are controlled through cartridge and rest buttons. Once the tool is set, inserts can be indexed and replaced without further adjustments. VBU precision cartridges are stocked in negative, neutral, and positive rakes.

Valenite Metals, Div of Valeron Corp, Box 205, Royal Oak, Mich

MORE DATA? Circle 65, inside back cover

3M Finishing Material Reported To Cut Finishing, Pickling Costs

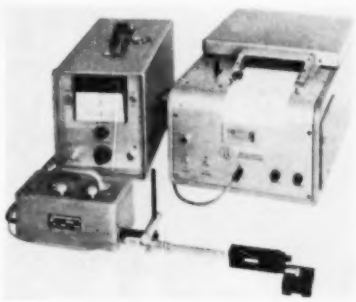
A new finishing material—nylon web impregnated with fine abrasive mineral—is reported to produce a unique finish on frabricated metals at lower cost than other finishing methods. It may also be used to reduce time and costs in pickling operations.

The materials called Scotch-Brite, is supplied in the form of 1-in.-thick disks which can be ganged on a common spindle to any width. It can be used on such metals as stainless steel, aluminum, zinc, copper, brass, and titanium. Not intended for stock removal, Scotch-Brite replaces buffing and polishing compounds for some final finishing. In one application, according to the manufacturer, use of the new material cut finishing costs on stainless steel window frames by 25% and increased polishing line production by 50%.

Used along a pickling line, Scotch-Brite is reported to cut pickling time and produce cleaner steel by getting to the bottom of scale pits better than most materials.

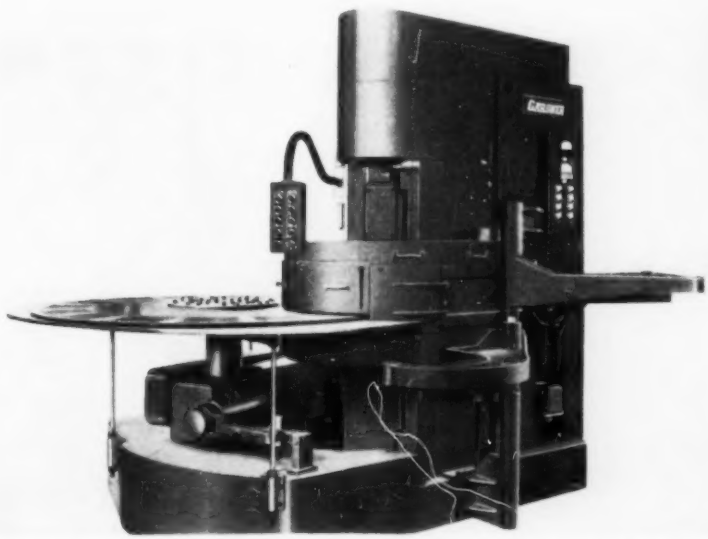
Minnesota Mining and Mfg Co, 900 Bush Ave, St Paul 6, Minn

MORE DATA? Circle 66, inside back cover



Instrument Measures and Records Roughness Profile of a Surface

Portable Microcorder is an electromechanical instrument which provides a permanent magnified chart record of the roughness profile of a surface. It is particularly useful for studying surfaces that are pitted,



DOUBLE VERTICAL SPINDLE GRINDER is specially designed to grind the ends of coil springs. It will grind springs up to 8-in. long between two 3-in.-thick, 36-in. dia abrasive disks, which are said to increase production 30% over previous 30-in. disks. Rotary carrier diameter is 78-in.—*Gardner Machine Co, Beloit, Wis*

MORE DATA? Circle 67, inside back cover

porous, have flaws, scratches, or other irregularities.

Pilotor in conjunction with the Linkarm provides the tracing motion and support. Length of trace is ⅛ in. minimum, 2¾ in. max. Tracing speed is 0.005 ips. Tracer range is ½ in. ID to Flat with FL skidmount, ⅜ in. OD to Flat with FM skidmount, Flats only with skidmount supplied.

Micrometrical Mfg Co, 345 S Main St, Ann Arbor, Mich

MORE DATA? Circle 68, inside back cover

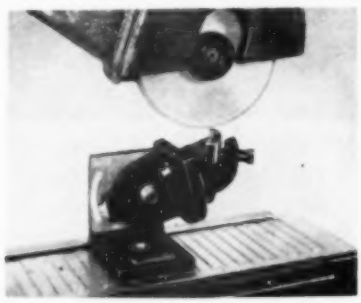
Cutter With Throw-away Inserts Said to Cut Milling Time 50%

Milling cutter, designed to use indexable cemented carbide insert blades of the throw-away type, is reported to reduce milling time, through tool changing and set-up, by as much as 50%.

Each insert sets in a precision ground pocket of the cutter body to assure greater rigidity. Each insert can be indexed to a new cutting edge in about 30 seconds by loosening a single holding screw, turning the insert 90° and tightening the screw. Inserts are available with four or eight cutting surfaces. Cutter body is produced in sizes from 4 to 12-in. dia.

Super Tool Co, Div of Van Norman Industries, 21650 Hoover Rd, Detroit

MORE DATA? Circle 69, inside back cover



Sharpening Fixture Designed For Gun Drill Heads

Sharpening fixture accommodates gun drills up to 1½-in. dia and is said to guarantee the grinding of exact point angles from 0 to 45° and exact relief angles up to 20°.

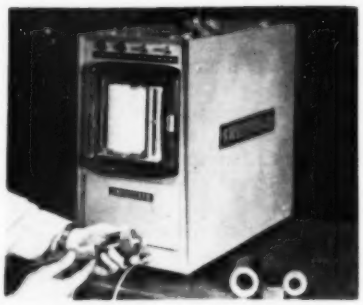
Each fixture comes with four ground locating blocks—a long and a short block for 110° flute angle and a long and a short block for 113° flute angle.

National Twist Drill and Tool Co, Rochester, Mich

MORE DATA? Circle 70, inside back cover

STEEL SHELLS FOR AIR-CONDITIONING COMPRESSOR UNITS are stamped in a single draw with a 400-ton Steelweld Speed-Draw Press at a rate of 100 in 64 minutes—80% faster than a standard crank press. The 22 ¾-in. dia blanks are 0.1644-in. draw-type steel. Finished shells are 11.35-in. dia and 11-in. deep—*Cleveland Crane and Engineering Co, Wickliffe, Ohio*

MORE DATA? Circle 71, inside back cover



Inspection Instrument Gages And Records Simultaneously

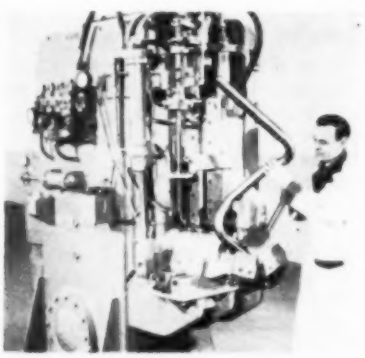
Inspection - recording instrument, which uses hand or fixture-type air gage tooling, automatically makes a record of each part's plus or minus deviation from nominal size on a 4-in. wide strip chart during gaging.

The standard Air Gage Recorder is supplied with continuous chart drive and will inspect a single dimension. Models are also available to check two dimensions and can be equipped with maximum and minimum signal lights, and an index drive to move the chart ⅛ in. on each gaging operation.

Back-pressure type air gage tooling is used as the size-sensing elements. Existing flow-type tooling up to 2000 to 1 amplification can generally be modified to suit the instrument. The device measures 9½-in. wide, 19½-in. deep, 17-in. high. It connects to the regular plant air line and 110-v, 60-c ac.

Sheffield Corp, Subsidiary of Bendix Aviation Corp, Dayton 1, Ohio

MORE DATA? Circle 72, inside back cover



Improved 20-ton Bending Press Features Offset Bending Ram

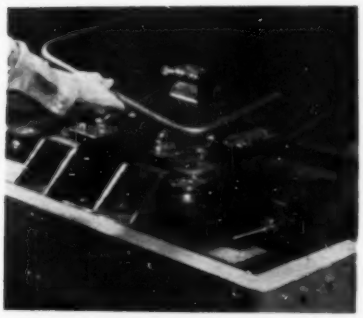
Model 1900 20-ton bending press, designed for high-speed progressive bending, handles work up to maximum steel tube sizes of 2-in. OD, 0.083-in. wall. Improvements include an offset bending ram that provides

more clearance for handling odd-shaped workpieces; a ram cylinder deceleration circuit that assures greater bending accuracy; internally drained hydraulic cylinders that prevent oil leakage around piston rods, and a heavy cast-steel C-frame that minimizes die deflection.

The new model retains such features as the 10-station angle-of-bend selector that automatically controls the depth of ram stroke and resultant bend angle, and the automatic resetting mechanism which eliminates cycling through idle stations.

Pines Engineering Co, Inc, 601 Walnut St, Aurora, Ill

MORE DATA? Circle 73, inside back cover



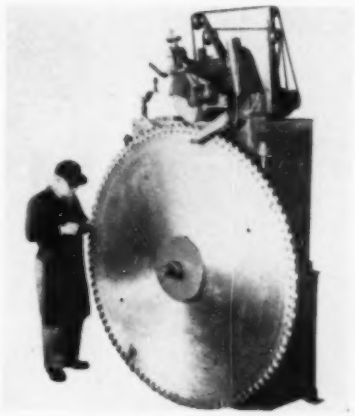
Double-Header Bender Makes Two 90° Bends in 1.5 Seconds

Bending machine is designed with two independent bending heads. In operation a tube is inserted in the clamp dies, operator presses a pedal, form dies swing forward automatically, lock into bending position, and clamp the tube. As soon as the form dies are locked, bending arms automatically rotate to predetermined bend angles. Operator releases the pedal and cycle reverses. Arms return, and form dies retract, freeing the tube for removal. Operator never releases the tube; loading, bending, and unloading is all done in one motion.

The Double Header will make bends two at a time or singly. For bending two at a time, length between centers of the bend radii is adjustable from 7 to 28 in. Each bend angle is independently adjustable from 0 to 100°. Machine bends any size tube up to ¾-in. OD steel tube. Standard equipment includes an air filter, regulator, and pressure gage. Both standard and special die sizes are available.

Costello Engineering Co, 6547 W Blvd, Inglewood, Calif

MORE DATA? Circle 74, inside back cover



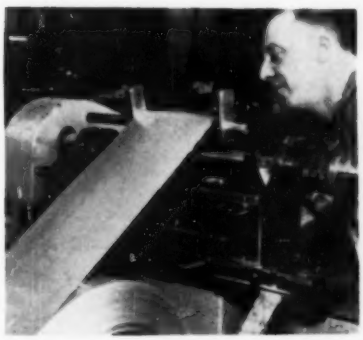
Metal Saw Sharpening Machine Offered in Heavy-Duty Model

No. 1184 is designed for all types of metal cutting saws up to 84 in. in dia. Rugged construction incorporates ball or roller bearings throughout.

Unit has provision for automatically forming high and low teeth, and for alternately beveling the tops of the high saw teeth. Teeth are generated by means of cam control and mechanism is adjustable to a wide range of tooth spacings and a wide range of depths of teeth. Length of stroke of the feeding mechanism and the stroke of the grinding head are adjustable by means of handwheel controls. Saw is fed by means of an index plate drive. Grinding wheel is 12 in. in dia and is driven by a 1-hp electric motor. Oscillating type ball bearings in the head construction eliminate the head slide mechanism and all power operated slides in the head construction.

Hanchett Mfg Co, 906 N State St, Big Rapids, Mich

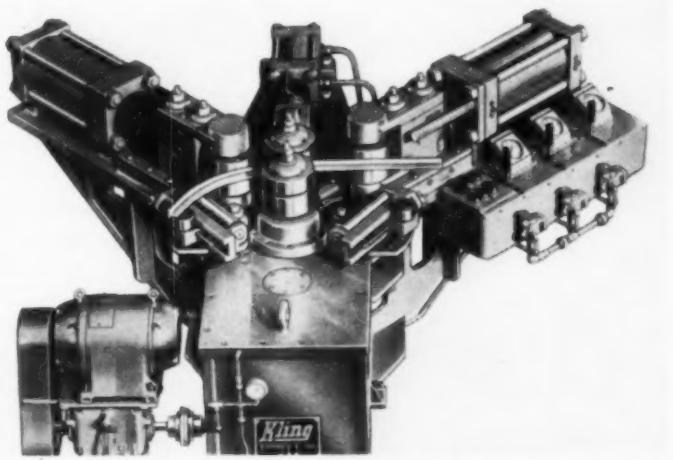
MORE DATA? Circle 75, inside back cover



Compensator Controls Winding Of Wire Strip on a Mandrel

The Roy Strip Winding Compensator is a compact unit which accurately controls the winding of wire strip on a mandrel. It is reported to make a more consistent package and eliminate air pressure guides or other types of winding guide controls.

Excellent results have been reported with strip materials of brass, phosphorous bronze, nickel silver,



HORIZONTAL HYDRAULIC DOUBLE PINCH ANGLE ROLL'S action permits elimination of 90% of the flat ends which are otherwise unavoidable in angle bending; operator can bend a steel section completely around the center roll. Construction features the movement of pinch rolls and gaging roll by means of heavy-duty hydraulic cylinders. Roll diameters are 8, 10, or 12 in.; max rolling speed of material with 12-in. rolls is 41.4 fpm—*Kling Brothers Engineering Works, 1320-32 N Koster Ave, Chicago 51, Ill*

MORE DATA? Circle 76, inside back cover

and stainless steel. Strips ranging from 3 to 25-in. wide and 0.010 to 0.070-in. thick have been processed without damage to strip's edges or surfaces, and on many occasions strip 0.002-in. thick has been processed with excellent results.

The compensator is powered by a ½-hp motor, and has an oscillating guide which prevents damage to strip edges. Price is $450 without the motor.

B S Roy and Son, Worcester, Mass

MORE DATA? Circle 77, inside back cover

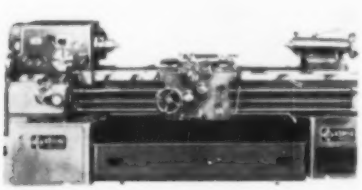
V-Anvil Micrometer Designed To Check Out-of-Roundness

No. 483 V-Anvil micrometer has three-point contact which detects out-of-round work, especially that produced by an improperly adjusted centerless grinder. It can also be used to measure three-fluted cutting tools such as taps, milling cutters, and reamers. A companion model, No. 485, measures five-fluted cutters.

The V-anvil mikes are used like conventional OD mikes. The cutter is held in one hand and the spindle face is set against one cutting edge with the cutting edge lined up with the spindle axis. Reading is taken in thousandths from the micrometer thimble.

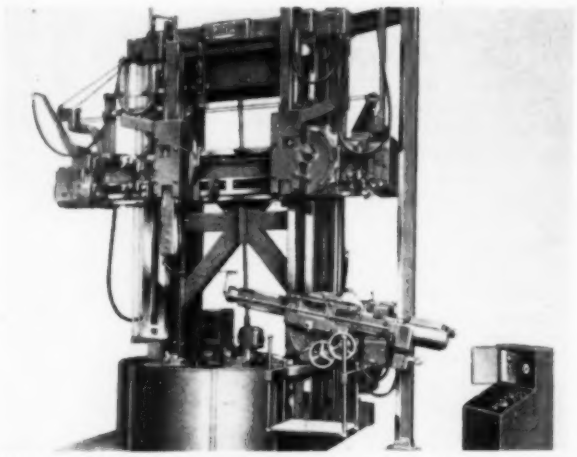
L S Starrett Co, Athol, Mass

MORE DATA? Circle 78, inside back cover



Swedish 24-in. Lathe Has 18 Speeds, 50 Feeds

Swedish 24-in. Koping lathe is rated for 20 hp and has spindle speeds up to 2,000 rpm. The 4⅜-in. OD spindle has a 2⅞-in. bore and a standard L-2 nose. There are 50 longitudinal feeds from 0.003 to 0.112 in., and 90 threads, from ⅛ tpi to 60 tpi can be cut.



BORING MILL DESIGNED FOR MISSILE WORK is reported to retain all general-duty machining facilities. This 72-in. machine has a swiveling side head for tracer controlled turning and grinding operations and a working height under rail and extended rams of 134 in.—*American Steel Foundries, King Machine Tool Div, 1150-A Tennessee Ave, Cincinnati 29, Ohio*

MORE DATA? Circle 79, inside back cover

Ways are flame-hardened and gear box and apron are fully enclosed. Apron lubrication system is automatic and also lubricates the ways. Unit is available with 40, 60, or 80-in. center distances.

Dist by Homestrand, Inc, 9 Addison St, Larchmont, NY

MORE DATA? Circle 80, inside back cover

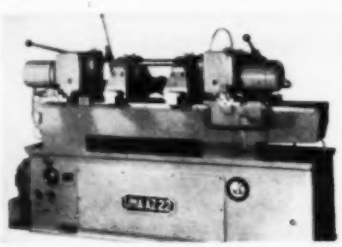
Universal Calibrated Fixture Speeds Band Machining

Fixture, a standard attachment that fits all power table DoAll band machines, consists of a massive back-up bar that locates in the table T-slots. Sliding head travels along the bar and can be quickly locked into position at any point. Scale on top of the bar is calibrated over a span of 22 in. so that either the left or right face of the sliding head may be used.

For facing, cropping, cut-off and similar work, operator sets the sliding head to the desired dimension, places the work against the back-up bar and head, and cycles the power table to make the desired cut and withdraw. For multiple pieces the sliding head may be left locked until all are completed.

DoAll Co, Des Plaines, Ill

MORE DATA? Circle 81, inside back cover



End Facing and Centering Machine Speeds Tracer Lathe Operations

UMA-AZ22, manufacturer in West Germany, cuts work piece blanks to size and at the same time prepares the centers. Available in capacities from 40 in. to 100 in. between centers, unit is fully automatic after initial loading operation. Once the piece is inserted a button is pressed and the cycle begins. A milling cutter brings the piece to uniform length and then the centers are inserted.

Because the spindles run counter to each other, right hand cutters are used on both sides. Milling speed can be preselected and coupled to a suitable speed of the centering drills. Milling spindles have a direct drive by three-speed motors.

Columbia International Corp, 10-35 44th Drive, Long Island City 1, NY

MORE DATA? Circle 82, inside back cover

LINDE's NEW PLASMARC TORCH SERVICE

Brings Industry Production Parts From Refractory Metals

No other method of fabricating refractory metals can match this. . . . The high melting points of tungsten, tantalum, and molybdenum are no longer a problem. For LINDE's new *PLASMARC* Torch, working in the temperature range between 15,000 and 30,000 degrees K., can coat parts or form shapes of virtually any size or complexity. It's an entirely new way to make such articles as rocket nozzles, crucibles, components for electronic and X-ray use, and parts for atomic energy equipment!

The quality of these pieces is uniformly high. Tolerances can be held to ±.002 in. or better. The metal loses none of its purity and superior density is achieved.

With the *PLASMARC* Torch, LINDE is equipped to supply you with parts made of, or coated with, refractory metals; or made of a variety of metals combined with non-metals or reinforced plastics. LINDE will also provide a wind-tunnel materials testing service based on this device. For information on this extension of LINDE's well-known Flame-Plating service, write Dept. AW-13, LINDE COMPANY, Division of Union Carbide Corporation, 30 East 42nd Street, New York 17, N.Y. In Canada: Linde Company, Division of Union Carbide Canada Limited.

The *PLASMARC* Torch employs a non-transferred electric arc to generate such high temperatures that powder or wire fed into the chamber is literally melted. Inert gases flowing continuously carry the metal particles in a plastic state and deposit them on the workpiece at near-sonic speeds. Jets of CO_2 cool the particles instantly to form heat- and erosion-resistant material. Coatings—even on graphite—have an excellent bond. Shapes are built up on machined mandrels, which are then etched away to leave parts such as those shown above.

Linde UNION CARBIDE

"Linde", "Union Carbide" and "Plasmarc" are trade marks of Union Carbide Corporation.

FIELD REPORT...

Warner & Swasey to Build Research Center in Ohio

Warner & Swasey's new facility will be constructed on a 12-acre site in Solon, Ohio. Purpose of the Center, which will comprise 40,000 sq ft of floor space, is to concentrate all of the company's R&D activities and personnel.

Specific research facilities will include separate machine design and systems design areas, a design and test section for servo mechanisms, special humidity-controlled design and experimental area for textile machinery, metal cutting and metallurgical research labs, plus a prototype shop capable of fabricating full scale working models of new product designs. Approximately one-third of the total structure will be devoted to high-bay test facilities. Construction is expected to be completed by year's end, with dedication in 1960 at the time of the company's 80th anniversary.

Sperry Plans to Expand Microwave Tube Production

Expanded production of microwave tubes for advanced radars, missiles, and counter-measures systems is scheduled at Sperry Electronic Tube Division of Sperry Rand in Gainesville, Fla. New high-power amplifying devices for more effective jamming of enemy radars and missile guidance systems will be produced at the facility. More than $2 million worth of special process equipment and automatic devices will be installed. Plant space will be enlarged by 28% to 121,000 sq ft by February 1960; employment will be increased by 30% to more than 800 by middle of next year.

New Company Established In Chemical Milling Field

Chemical Milling International Corp has been formed in the Los Angeles area for production, consulting, and research. Offices and factory are in El Segundo; operations will be international in scope. President and sales manager of the new firm is Frank L Bailey, a pioneer in the field who has long been active in promoting its advantages. E Lawrence Brevik, CMI's technical director, supervised the Chemical Milling Division's technical department at Turco Products, Inc.

Chrysler to Build M-60 Tanks

Chrysler Corp has received a letter contract for $2.8 million to buy tooling equipment preliminary to a production contract of approximately $20 million for construction of 180 M-60 tanks. They'll be produced at the Lenape Ordance Modification Plant at Newark, Del. Deliveries are scheduled for next spring.

$8 Million Order to Convair

Convair's Fort Worth plant has an AF contract for procurement of long-lead-time items for 40 additional supersonic B-58 Hustler bombers. Order implements production beyond the 66 Hustlers ordered to date.

Illinois Tool's New Division

Illinos Tool Works, Chicago, has established the Pacsol Division at El Segundo, Calif. Unit will carry on the business originally conducted by Pacific Solenoids, Inc, assets of which were acquired by ITW in April 1958. In addition to rotary solenoids, engineering and production will also be continued on complete package units of rotary switch mechanisms.

Thermoelectric Air Conditioning

Navy has contracted with Carrier Corp, Syracuse, for design studies to test the feasibility of thermoelectric heating and cooling in shipboard air conditioning. The 18-month program involves preliminary design and analysis. Successful completion will lead to large-scale development of thermoelectric heat pumps containing no moving parts, according to Dr J F Downie Smith,

"It's a collection for somebody in the Shipping Department. Her cousin on her mother's side had triplets."

No heat distortion and more power in the cut with G&L table and bed construction

G&L vertical boring mill tables ride on a large preloaded, tapered roller center bearing and one or two antifriction roller bearing tracks. The center bearing prevents misalignment of table and work due to radial thrust. Preloading of the bearing eliminates need for clamps and hold-down devices to prevent table tilting during machining.

Use of single or double roller tracks depends on loads—a second track increasing capacity fivefold. For example, the 12-ft VBM readily handles 125-ton workpieces across its entire speed range.

Unitized bed and transmission assure a level, smooth-running table and eliminate need for a pit because internal adjustments can be made from the top.

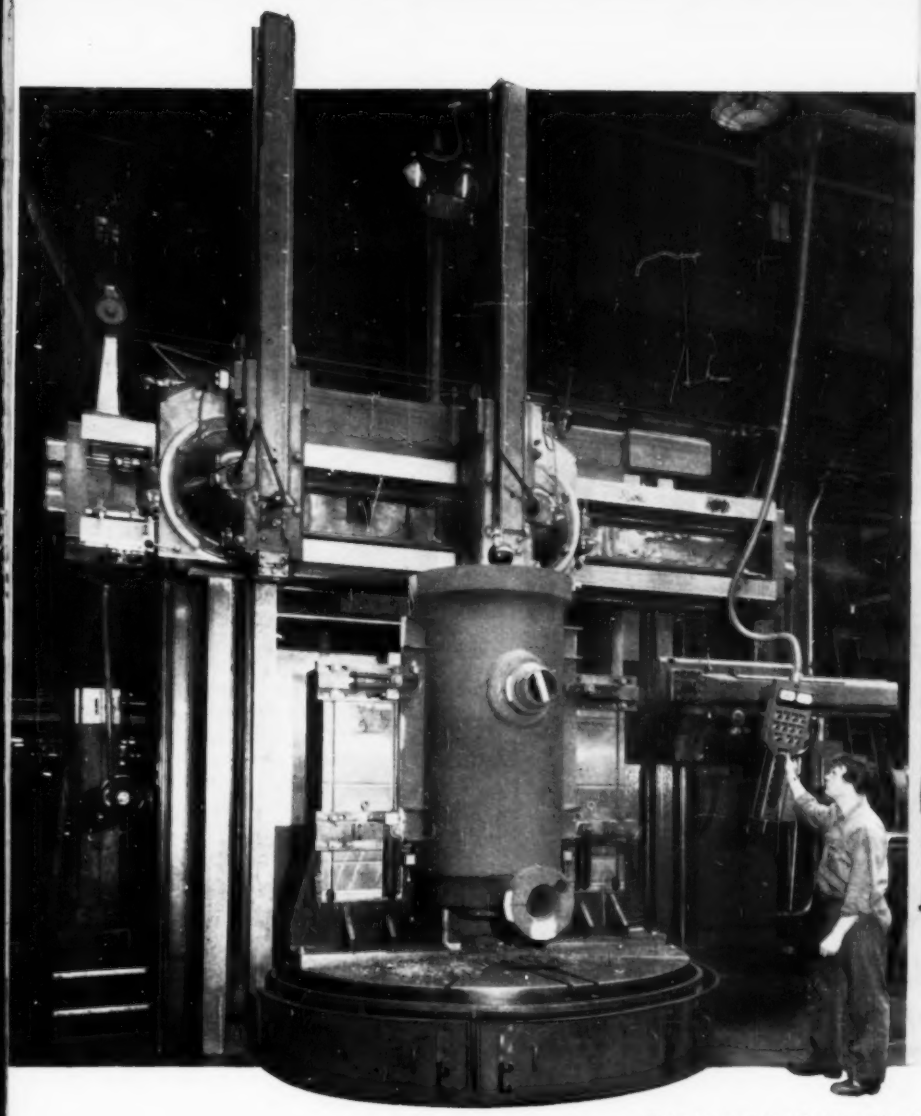
All this adds up to less friction, less heat, freedom from distortion, and more power in the cut.

symbol for machining cost reduction

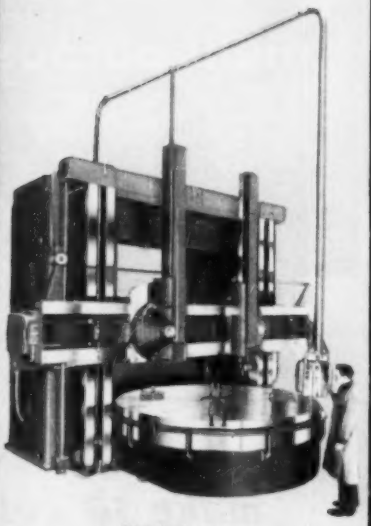
VMB-100

GIDDINGS & LEWIS

CIRCLE 242 READER SERVICE CARD



GIDDINGS & LEWIS



Standard sizes
54-inch through 20-foot

Photo courtesy Allis Chalmers Manufacturing Co., West Allis, Wisconsin

G&L roller bearing table tracks speed up precision machining on any size workpiece

You can turn out any job faster on a Giddings & Lewis vertical boring mill because of the table and bed construction described at the left.

You can run at higher speeds or heavier feeds or both because more horsepower is put to work at the tool and less is consumed in turning the table. The low friction and resulting low heat build-up permit you to run any size workload *continuously* without loss of accuracy.

Efficient, accurate operation at highly increased speeds permits use of carbide and ceramic tools, even when turning small-diameter work.

Complete reliability of design has been exhaustively proved—no Giddings & Lewis antifriction table track has ever failed in service.

For complete information on the antifriction table and the many other features of this productive, completely pendant-controlled machine tool, call your Giddings & Lewis distributor or write for Catalog VBM-4.

GIDDINGS & LEWIS MACHINE TOOL COMPANY
Fond du Lac, Wisconsin

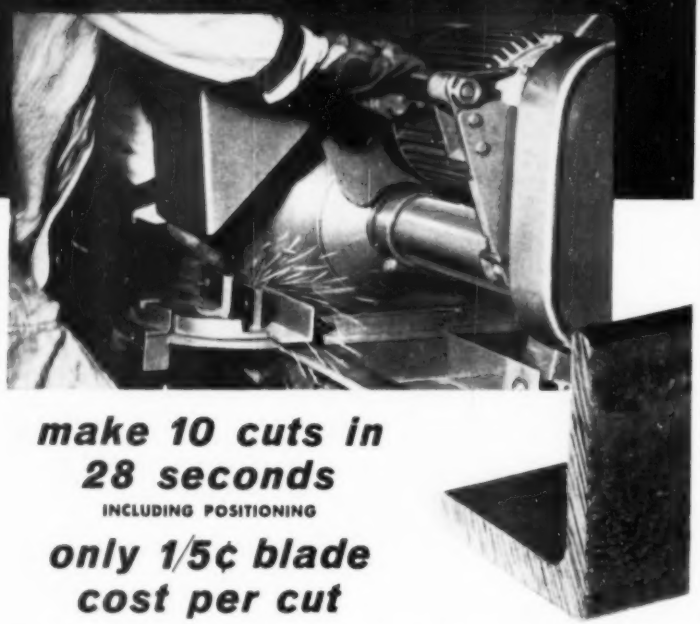
Giddings & Lewis manufactures: vertical and horizontal boring machines, vertical turret lathes, planers, planer mills, contour milling machines, die sinking machines, drilling machines, numerical and tracer control systems, boring tools and related items, and machine tool accessories.

New concept

IN LOW COST CUTTING OF STEEL

PROMACUT

multi-purpose cut-off saw



make 10 cuts in 28 seconds

INCLUDING POSITIONING

only 1/5¢ blade cost per cut

The standard PROMACUT unit without extras does any job you're now doing by hacksaw, bandsaw, abrasive or friction cut-off . . . and does it faster, cheaper and more simply. Makes accurate straight and angle cuts, notches, outcuts and incisions—by free-hand or table cutting. Check the quality and savings in features below.

OTHER TYPICAL EXAMPLES OF MAXIMUM SPEED AT MINIMUM COST

Stock (Mild Steel)	Time, Secs. Per Thru-Cut	Min. Cuts Before Sharpening	Blade Cost Per Cut
3/4" dia. Round	0.6	2500	.0027¢
3/16" Flat x 7" length	0.9	3400	.0020¢
2" Square Tube, 1/4" Wall	1.8	2000	.0034¢
4" dia. Tube, 1/8" Wall	1.2	3600	.0019¢
3" x 3 1/2" x 3/8" Angle	3.6	1200	.0057¢

- No coolants needed
- No clamping or hold-down
- Cuts smooth—practically burr-free
- Cuts all shapes of carbon, stainless and alloy steel
- Long blade life
- Cuts 4" angle, 1 1/8" round, 4 1/2" tube, 5" H

WRITE FOR DETAILS . . . ASK FOR MOBILE DEMONSTRATION AT YOUR PLANT

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P. O. Box 322, Dept. A, Oakton Station, Des Plaines, Illinois

DEALERS: Some territories still open—write on letterhead

Field Report . . .

R&D vice president of Carrier. The pumps produce cooling and heating directly from the action of an electric current on certain combinations of materials, eliminating noise of refrigerating compressors or pumps used in present air conditioning systems. Although the principle has been known for many years, lack of efficient thermoelectric materials has slowed development. Only relatively small and primarily experimental heating and cooling devices have been produced to date.

Allis-Chalmers Acquiring Firm

A-C is planning to acquire through exchange of stock the Lakefield Manufacturing Co, Wauwatosa, Wis. A memorandum agreement between the companies is subject to approval by Lakefield's directors and stockholders. Firm, which makes component parts for tractor shovels and side booms used on construction machinery equipment, has been a supplier to the Tractomotive Corp, recently taken over by A-C.

Airborne Instruments Laboratory Buys Fairchild Engine Plant

AIL Division of Cutler-Hammer, Inc, has purchased the 493,000 sq-ft Fairchild Engine Division facility at Deer Park, Long Island. Sale price for the plant and 100 acres of the 386-acre industrial site owned by Fairchild was not disclosed. Included in the purchase are all the buildings, plus the foundry, heat treat, and plating installations. Fairchild had constructed the plant in 1955 to de-

"Go on with the run—What're you waitin' for—three cheers?"

Everybody knows that
National Tool Company
makes all types of
high-speed form tools—

But did you know
we make all types
of carbide-tipped
form tools . . .

and more special cutting tools of all kinds
than any other tool manufacturer?

For more than half a century National Tool Company has supplied high quality precision cutting tools to the metal working industry. When your job requires special cutting tools call your National Tool representative. His assistance is yours for the asking whether you're interested in one special tool or a complete tooling program.

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Representatives in major industrial centers

New FREE Catalog

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Please send NEW 92 page catalog showing National Tool Company's complete line of special tools for the metal-working industry.

Name_____

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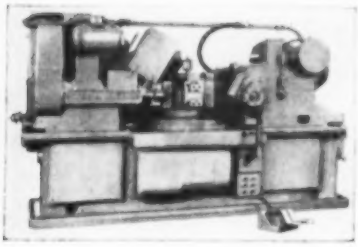
No second operations necessary on the NEW



GOSS and DE LEEUW
CHUCKING
MACHINE

When any of the various functions for which this machine is designed are performed on it, no further machining is required. The job is finished.

The basic "1-2-3" method . . . exclusive with Goss & De Leeuw . . . provides for gripping work in the chuck and machining all ends either simultaneously or in sequence. By eliminating several handlings and set-ups, the "1-2-3" method produces finished pieces at a fraction of the time and cost ordinarily required.

Send samples of your work for time estimates. Ask for illustrated literature containing detailed information.

GOSS & DELEEUW
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MACHINE COMPANY, KENSINGTON, CONN., U.S.A.

Field Report . . .

velop and manufacture turbo-jet engines. Cancellation of its engine contract in January led to closing of the Engine Division. AIL will transfer by year's end approximately 1300 people to the new plant from its various facilities in Mineola, Garden City, and Huntington, Long Island. Plant employed 3000 last year.

Lockheed's Georgia Division . . .

. . . at Marietta, has installed a $100,000 chemical milling machine for use on the 50-ft-long aluminum wing panels of the company's Jetstar. Plant has three 60-ft-deep vats which can accommodate pieces of metal up to 36 in. by 50 ft. Machine utilizes a boom to dip the wings into the vats; they are machined at a rate of one foot per minute.

Chromalloy Acquires LA Firm

Chromalloy Corp, White Plains, NY, has taken over the Chromizing Co of Los Angeles, will operate it as a subsidiary. Started in 1952 as a licensee of Chromalloy, the California firm specializes in the processing, development, and production of metal coatings and alloys.

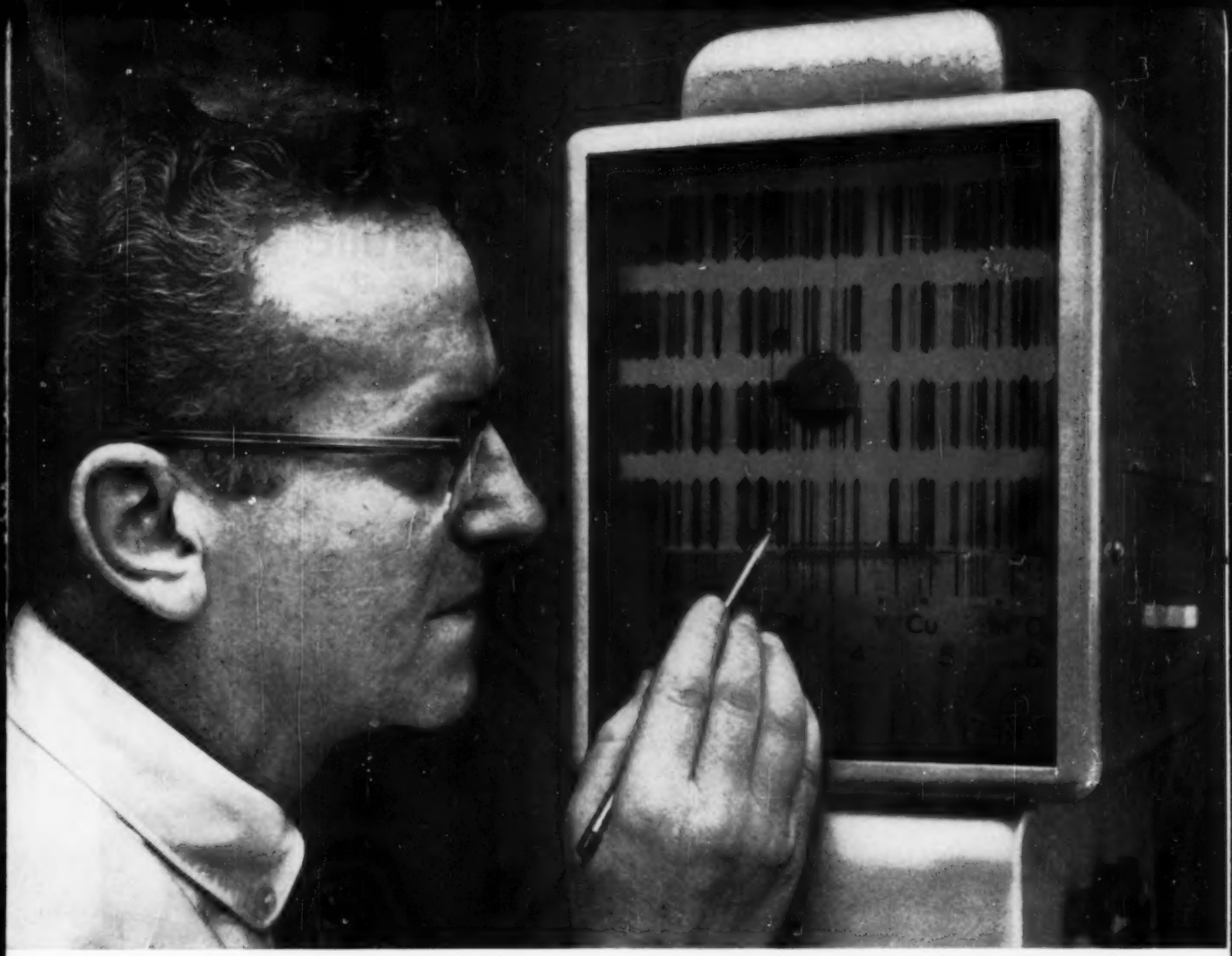
General Electric Plants . . .

. . . in Waynesboro, Va, and Erie, Penna, will supply the major components for the electrical power generating systems of the North American D-70 bomber and F-108 interceptor projects. Contracts were awarded by Sundstrand Machine Tool Co's Aviation Division of Rockford, Ill, secondary power subsystem manager for North American.

(continued on p129)

WELDING SUPPLIES

"A flame cutter! What on earth do you want to cut flame for?"



Using this microphotometer, Jessop can detect and measure the per cent of even trace elements in a sample of specialty steel.

"How Jessop reads your specialty steels!"

—C. M. Carlisle, DIRECTOR OF ANALYTICAL CHEMISTRY

"If you're ever near the Jessop plant, stop in and ask for a tour through our chemical laboratories.

"There you'll see how Jessop makes certain you get the exact per cent of alloying elements specified for your specialty steel.

"For example, you'll see a *microphotometer* — that's what I'm peering at so intently in the above photograph!

"I'm studying a film showing the spectrum of a sample of steel from Jessop's No. 2 electric arc furnace. Each chemical element in this specialty steel appears as a distinct line. By reading these lines, I can detect even minute *traces* of elements and after some simple calculations, determine the per cent of each."

This modern chemical laboratory is one more reason why you get your specialty steel tailor-made to your order . . . and you get it on time. **Specify Jessop . . . and then relax!**

VMA 6719

JESSOP
STEEL COMPANY
Washington, Pennsylvania

Subsidiary Companies:
Green River Steel Corporation, Owensboro, Kentucky • Jessop Steel International Corporation, New York City
Jessop Steel of Canada, Ltd., Wallaceburg, Ontario • Steel Warehousing Corporation, Chicago, Ill.

Stainless, alloy, tool, cast-to-shape, and forging steels, precision ground flat stock, and other specialty steels

Precision BORING, FACING AND UNDERCUTTING

with the "closed circuit" hydraulic system

SWINTOOL

Example of work carried out by the "Swintool" Head without disturbing fixing.

The Swintool converts your Mill into a precision Boring machine. The 5″ with extension faces to 10″ —8″ Head with extension faces to 20″ or 32″.

The Swintool is capable of Boring, Facing, Recessing, Backward Facing, External Turning. Highly accurate on repetition work. Vernier setting of 0.0005″.

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Patented throughout the world.

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Field Report . . .

Hercules Working on Minuteman

Hercules Powder Co, Wilmington, Del, has a $15.3 million AF contract for research and development of a third-stage engine for the solid-fuel-propelled ICBM. Order defines an earlier letter contract which authorized Hercules to start work on the project. Major portion of the work to be performed under this contract will be carried out at the company's multimillion-dollar rocket propellant facility at Bacchus, Utah, with supporting technical work to be carried out at the company's propellant plant at Kenvil, NJ.

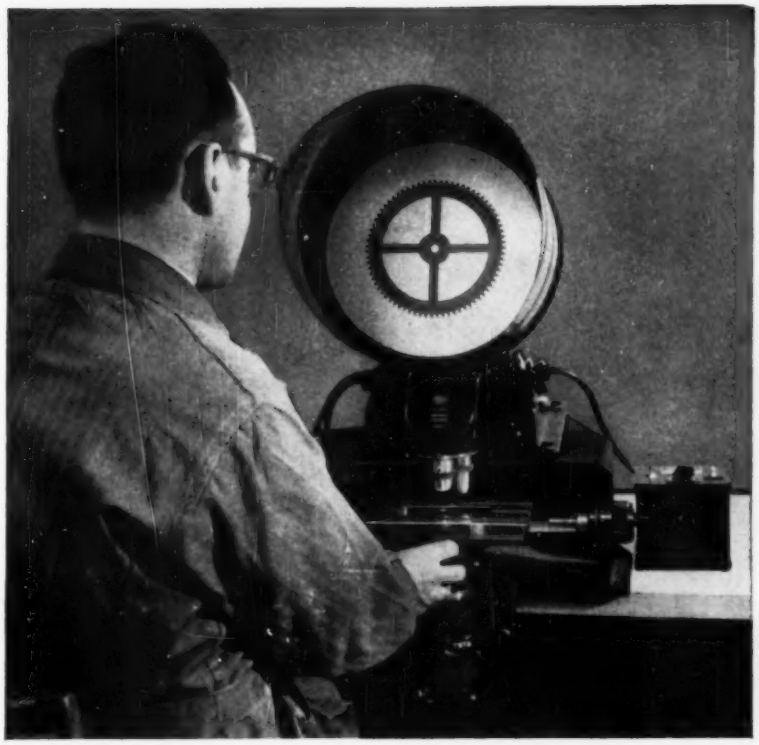
Fischer & Porter Co . . .

. . . Hatboro, Penna, manufacturer of industrial instruments, data reduction and automation systems, has formed an autonomous company for the production of fiber glass reinforced plastic parts. Called the Warminster Fiberglass Co, it'll furnish all plastic parts required by F&P, and will also solicit outside business.

Atomic Aircraft Systems . . .

. . . will be tested at Georgia Nuclear Laboratories, Dawsonville. Operated by Lockheed Aircraft's Georgia Division, the Lab will conduct tests to determine how well various systems, parts, and materials function in the presence of radiation. Lockheed officials say that 50 government agencies, in addition to the Air Force, are interested in using the facility, and they've received queries relative to use in the fields of electronics, hydraulics, magnetics, and chemical propellants.

"Let me explain throw-away toolholders again."



this instrument will give you a decided edge in every competitive situation

NIKON OPTICAL COMPARATOR

for critical inspection and measurement of high-precision parts

A small investment, in one Nikon Optical Comparator, will spell enough economies to make a marked difference in your cost-competitive position. One, it will virtually eliminate the need for expensive mechanical gages. Two, it will release trained and skilled personnel for other critical work. And three, it will generally increase the efficiency, speed and accuracy of your quality control operation.

Inspection with the Nikon Optical Comparator is simply a matter of comparing the magnified image of the part under inspection with a master chart of a drawing affixed to the viewing screen. Precise measurements can be made of the most intricate contours—at a glance—by operators with comparatively little training. Further, accurate inspection of surface details and finishes can also be made. Thanks to Nikkor optics, the image is so bright and of such high resolution, that the entire inspection may be carried on in any normally well-lit room. And it can be viewed by several people at the same time.

So precise is the Nikon Comparator, that its use has enabled plants to enter into high-precision fabrication, and to achieve tolerances not available by any other methods. The Nikon Bench Model II can be easily carried from one part of the plant to another, for on the spot inspections and measurements, reducing "down time." Photo records of the image can be made in black and white or color.

It will pay you to investigate how a Nikon Optical Comparator can improve the cost-competitive picture of your organization. For complete details, write to: Nikon Incorporated, 111 Fifth Ave., New York 3, N. Y. Dept. AM-6.

WHEN BUYING FOR PRODUCTION—equipment, accessories, materials, supplies—the question often arises: "Who makes it? Where can we get it?"

Reach for the American Machinist Buyers' Guide Issue and you have the answers in an easy-to-use, complete and efficient package.

Bigger... and most complete The newest edition of the Buyers' Guide—your most effective, efficient buying tool—is now in preparation. To be issued in September, 1959, the Buyers' Guide Issue will put at your fingertips the...

Buyers' Guide Section...over 27,000 listings...products of 3,400 manufacturers shown under 1,800 separate product headings;

Metals Supply Section...city-by-city listings of steel warehouses (with types available) plus warehouse list of non-ferrous metal sources (aluminum, copper, brass);

Machine Tool Distributor Directory...local sources for machine tools in your area...presented both alphabetically and by machine tool builders ...with phone numbers and addresses;

Technical Metalworking Sections ...eight editorial-advertising sections covering principal Metalworking functions (Machining, Tooling, Press-Working, Inspection, Materials, etc.).

Easy to use...for you The American Machinist Buyers' Guide Issue is designed with *your needs in mind*. Sim-

plicity of use by production executives guides its preparation. Thus you get...

integrated information sections... major portions of the issue work together... Buyers' Guide Section leads you to Warehouse and Distributor directories... bold-face listings for advertisers refer you to specific pages where you can obtain complete application/specification data from manufacturers;

different colored paper for major sections...enables you to put your hand on exactly the information desired without time-consuming searching... no complicated code references;

"lie flat" binding...allows you to leave volume open at a specific page for reference without losing your place.

Preferred by production management

Just as regular issues of American Machinist are your best source for information on techniques, processes and "what's new", so the Buyers' Guide has become accepted as Metalworking's #1 buying data source.

In a survey* among American Machinist subscribers, it was found that, next to the Yellow Pages of the phone book, the Buyers' Guide was Metalworking production management's most popular reference for industrial product source data.

If the product is made or bought by Metalworking...look first for the source in the Buyers' Guide Issue (the new edition in your hands September 1959).

*available on request

THIS IS A DRILL JIG

THE FASTEST, LOWEST-COST DRILL JIG IN METAL WORKING TODAY

Using tape controls to cut tooling costs is a fact.

Ask us to prove it. We will program your parts and demonstrate.

Details and photographs of a variety of parts, compared with conventional machining costs, are available on request. Growing savings and greater profits from new applications are coming in every day.

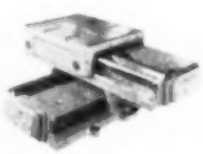
The Complete Standard System

The DIGIMATIC* MODEL 202 Control System includes all equipment necessary for numerical control of point positioning operations.

- **Special Punch Tape Preparation Unit** that is as simple to operate as an adding machine. No complicated computer language to learn.
- **Control Console**—a compact unit, operator-maintained, with shop-proven reliability.
- **Servo Table**—adapted to drilling machines in one day. Automatic positioning on ball bearing ways. Anti-backlash lead screws.

Write for free 12-page booklet "DIGIMATIC MODEL 202." Also—movies shown at your shop or plant on request.

Tape Unit



Table

Control Console

*DIGIMATIC IS OUR TRADEMARK

STROMBERG-CARLSON
A DIVISION OF GENERAL DYNAMICS CORPORATION
1491 N. GOODMAN STREET • ROCHESTER 3, N.Y.

S-C | G-D

Free Literature

To order any of these bulletins, circle corresponding number inside back cover.

MACHINES AND ATTACHMENTS

1 "AUTOMATIC SCREW MACHINING OF ALUMINUM" — *Reynolds Metals Co, Box 2346, Richmond 18, Va.* 32-page illustrated technical handbook covers single and multiple-spindle automatics, design and nomenclature of tools, most suitable aluminum alloys and cutting lubricants. Separate chapters describe various operations such as external cutting, forming, end working, internal cutting, threading, knurling, and cutoff.

2 GEAR CHECKERS—*National Broach Machine Co, 5600 St Jean, Detroit 13, Mich.* 16-page bulletin C55-9 provides data on equipment that inspects gears for index errors, eccentricity, wobble, lead or helix angle errors, size, and tooth parallelism. Specifications and capacities given for three models of universal gear checker and lead comparator.

3 MACHINERY REPLACEMENT — *Heald Machine Co, 10 New Bond St, Worcester 6, Mass.* 14-page illustrated fold-out brochure gives details on how replacement of old machines paid off for six manufacturers. The six analyses pictured show how savings in production costs ranging from $6109 to $29,222 were achieved by replacement.

4 10-TON HYDRAULIC UNIPUNCH PRESS—*Punch Products Corp, 3800 Highland Ave, Niagara Falls, NY.* 4-page catalog 1012-1 illustrates and describes air-hydraulic unit complete with precision Unipunch gaging and tooling for punching holes in angles, channels, extrusions, and sheets, plus notching operations.

TOOLS AND ACCESSORIES

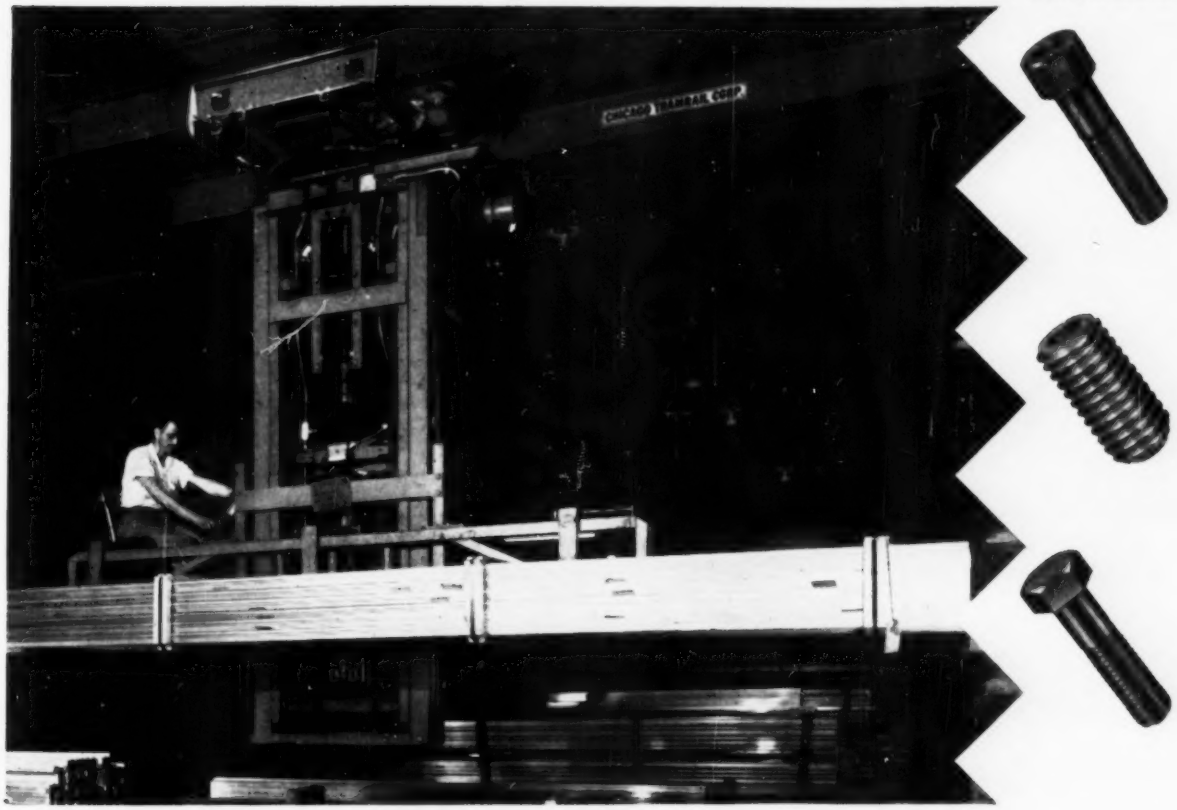
5 HSS TAPS — *Besly-Welles Corp, South Beloit, Ill.* 29-page catalog 802 contains illustrated descriptions of full line of standard taps plus specials now carried in stock. Data included on new standard units for freer cutting in cast iron. Tables provide information on sizes, class of fit, limit numbers, gage data, and tap drill and thread engagement for all common materials. Drill diameter chart shows exact diameter of drills marked by number, letter, fractions, or metric sizes.

6 MAGNETIC TAPE INSTRUMENTATION — *Minneapolis-Honeywell Regulator Co, 10721 Hanna St, Beltsville, Md.* 24-page catalog DC-3171 describes and illustrates multichannel systems for laboratories, test cells, telemetering recording.

(Continued on page 136)

"Oh, I like the government, alright. It's just that I get the feeling they don't like me!"

IT PAYS TO STANDARDIZE ON STANSCREW



17 different Stanscrew fasteners used in Chicago Tramrail's Trak-Rak

"In constructing our complete line of cranes we make no compromise with the most rigid requirements of safety," says S. W. Fountain, Vice-President, Chicago Tramrail Corporation. "Therefore, reliability is our principle reason for standardizing on quality components such as Stanscrew fasteners."

"But Stanscrew gives us more than fast service and reliable products. Their broad line of over 5,000 fasteners offers a wide selection . . . and their fastener specialists and engineers are always ready to assist our design department in determining the strongest, safest, most economical fastener for every application. For example, in our Trak-Rak stacking crane above, 17 different Stanscrew fasteners are used . . . each selected after careful study for the precise job it has to fill."

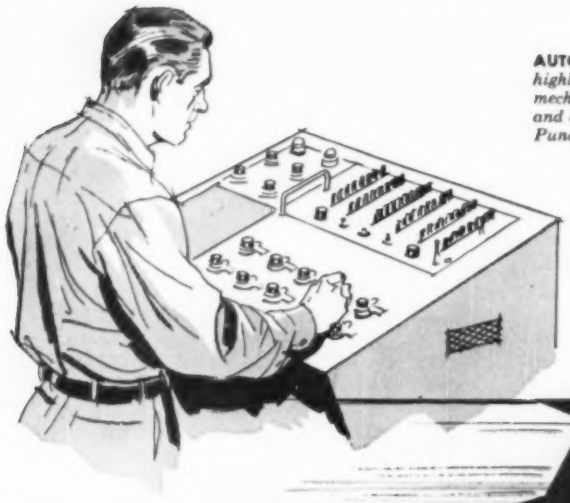
Like Chicago Tramrail, many other industrial leaders have learned it pays to capitalize on Stanscrew's backlog of over 80 years of fastener experience. To use this accumulated knowledge in solving your particular fastener problem, just call your Stanscrew distributor. He will quickly arrange for a visit from your Stanscrew fastener specialist.

STANSCREW FASTENERS

CHICAGO | THE CHICAGO SCREW COMPANY, BELLWOOD, ILLINOIS
HMS | HARTFORD MACHINE SCREW COMPANY, HARTFORD, CONNECTICUT
WESTERN | THE WESTERN AUTOMATIC MACHINE SCREW COMPANY, ELYRIA, OHIO

STANDARD SCREW COMPANY 2701 Washington Boulevard, Bellwood, Illinois

CIRCLE 253 READER SERVICE CARD 133

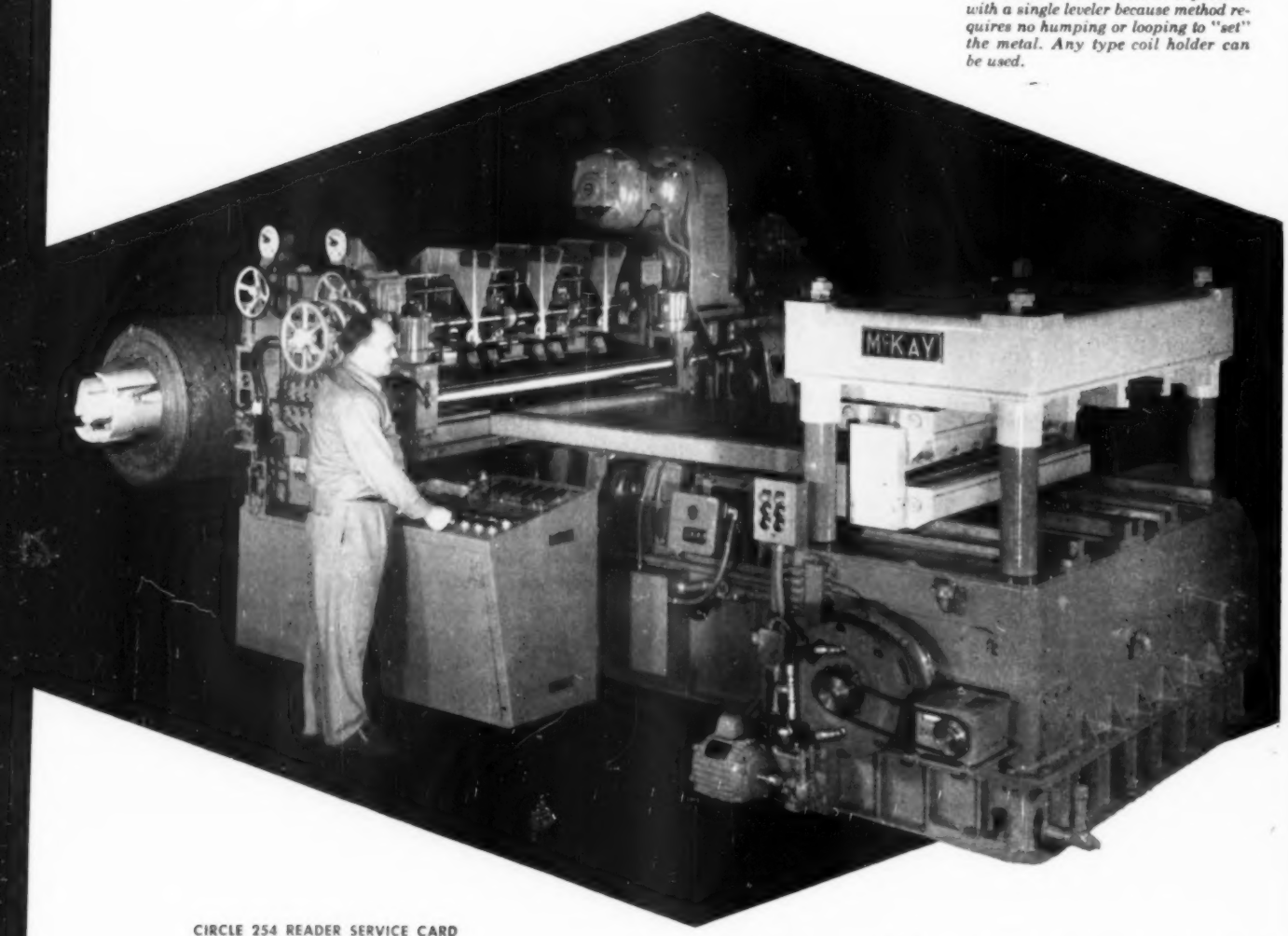


AUTOMATIC, INSTANTANEOUS *because of highly accurate electronic counting and measuring mechanisms. Operator simply sets length and quantity by push buttons, shear does the rest. Punched tape or coded card control available.*

LOW MAINTENANCE *because all drives and controls are simplified AC type, electronic controls are proven standards, cutting dies are standard double-rake shear knives.*

Break

COMMERCIALLY FLAT SHEET *is possible with a single leveler because method requires no humping or looping to "set" the metal. Any type coil holder can be used.*



CIRCLE 254 READER SERVICE CARD

COMPACT *. . . never before has such a high production unit required so little area. Space saving, it's ideal for warehouse operations.*

through...

in AUTOMATIC SHEARING

Revolutionary McKaymatic* high production Die Shear line instantly responds to length and Quantity Command

Now—a high production cut-to-length line that meets *all* the requirements of modern day coil shearing. It's the revolutionary new McKaymatic* Die Shear Line and it's fast, extremely accurate, instantly adjusted, compact and relatively low in cost!

The McKaymatic* is applicable for use wherever sheet metal is used. Ferrous and non-ferrous mills, fabricators or warehouses should see this amazing new line before they decide on the purchase of new coil shearing equipment.

UNMATCHED FLEXIBILITY offered by a simplified electronic control makes the changing of length of cut instantaneous. When length and quantity commands are changed (manually or automatically) the line reacts instantaneously without slowing down or stopping. EXACTING ACCURACY, also a product of electronics, is equal to or better than any other available equipment. HIGH PRODUCTION, regardless of the number of length changes is possible because there is no downtime for length changing, etc. LOW MAINTENANCE is possible because the line is designed around simple AC drives and controls, and proven electronic components.

There's nothing like it—for large orders or small—in any width or thickness. Here for the first time is practical push button shearing, and it's easily adapted for standard coded card or punched tape systems. For details write today. *The McKay Machine Company, Youngstown 1, Ohio.* *TM

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Fiction:

Beware of fiction in the cheaper threading tool story. The truth is you want more quality threads for your cutting tool dollar. Eliminate the fiction in your cost story caused by production variables which affect your profit dollar. Hanson-Whitney's *complete* line of standard gages and cutting tools, featuring *"free-cutting action,"* insure the consistent quality necessary for a steady flow of quality products.

Complete and Related "STANDARDS"

What you want is a single source for standard threading tools and gages. It's *fact*, not fiction, that your Hanson-Whitney distributor is the single source for these *quality tools. What you want* is a source for complete and related threading service. Your Hanson-Whitney distributor is the threading specialist providing these services—backed up by Hanson-Whitney's forty years of thread engineering and experience.

Hanson-Whitney
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206A BARTHOLOMEW AVE., HARTFORD, CONN.

STANDARD: Taps • Thread Gages • Cutters • Fine Pitch Gear Hobs

Free Literature

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and other precision applications. Covers typical systems and features; applications; basic factors in system selection; system and component specifications. Performance specs are given for transports, FM PDM, direct and digital tracks.

7 TAP AND GAGE SELECTOR CHART—*DoAll Co, Des Plaines, Ill.* 22 x 28-in. chart lists the DoAll tap, tap drill size, and plug and ring gages needed to produce and check classes of thread. Shows all standard NC and NF sizes as well as many NEF and N sizes considered special. For any class of thread being used, chart indicates the Go and No Go thread work plug gage PD's for checking internal threads, the tap required to produce that class of thread, tap drill size needed, PD limits of the tap, and the Go and No Go thread ring gage PD's for checking external threads and setting plug gages.

8 GUN DRILLS — *Cleveland Twist Drill Co, 1242 E 49th St, Cleveland 14, Ohio.* 16-page illustrated manual explains how units can be used on critical drilling jobs involving fine finish, accurate size, pinpoint location, and holes of all depths. Pictures various types of shanks, bodies, and heads. Gives recommendations on machines for gun drilling, feeds and speeds, starting bushings, and coolant systems. Point styles discussed plus instructions on resharpening.

9 "CARBIDE GRINDING WITH MAN-MADE DIAMOND WHEELS" —*Carborundum Co, Niagara Falls, NY.* 4-page illustrated brochure is a condensation of facts and recommendations; discusses characteristics of man-made diamonds, diamond wheel shapes, and applications.

● UNIVERSAL TOOLMAKER MICROSCOPE—*Opto-Metric Tools, Inc, 137 Varick St, New York 13, NY.* 12-page catalog presents illustrated data on Leitz Model UWM with 2.35 x 6-in. measuring range. Features, application, operation covered; detailed specifications include obtainable working accuracies. Request direct on company letterhead.

10 HAND TACHOMETERS — *Jones Motorola Corp, 432 Fairfield Ave, Stamford, Conn.* 4-page illustrated catalog 61 gives details on Models 1600, 3200, 4800, 1HT and 3HT. Includes sizes and ranges available, price information, and data on standard accessories.

11 RECORDERS AND RECORDING CONTROLLERS — *General Electric Co, Schenectady 5, NY.* 12-page bulletin GEA-6887 describes new family of continuous self-standardizing strip-chart units for measurement of electrical and process

"It's got so a good kick won't fix it."

This valve gets a leak-proof seal from a Blanchard Surface Grinder

"The Blanchard Surface Grinder is one of the most important improvements in our modernization program." This report comes from the Commercial Refrigeration Division of Bendix-Westinghouse Automotive Air Brake Company—makers of power and condensing units for refrigeration equipment.

The Blanchard No. 18 Surface Grinder puts a surface of 5 micro inches or better on Bendix-Westinghouse valves at the rate of 75 pieces an hour.

A Blanchard Model 18 Surface Grinder is used to finish grind valve plates used in Bendix-Westinghouse electric refrigeration compressors. They say: "This operation is very important, because—with a surface finish of five micro inches or better—we get a perfect seal on our gaskets and valves, eliminating the possibility of leakage."

Is there room for improvement in *your* surface grinding? For best results...

Write today for your free copy of "Work done on the Blanchard," fifth edition, and "The Art of Blanchard Surface Grinding," fourth edition.

PUT IT ON THE BLANCHARD

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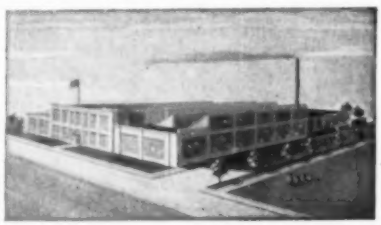
Here's how CDT can help you

CDT CAN INCREASE YOUR PRODUCTION
. . . because CDT specializes in designing and building tools and machines for today's high production demands.

CDT CAN IMPROVE YOUR QUALITY
. . . because CDT tools, jigs, fixtures and machines are precision engineered and built to the strictest requirements.

CDT CAN LOWER YOUR PRODUCTION COSTS
. . . by increasing the efficiency of your operation with special tools that do the job better—faster—more economically.

Call on Columbus Die-Tool for your special tooling problems. A large creative engineering staff with experience in developing special tools and machines for hundreds of industries is at your service. Over 50,000 square feet filled with precision production equipment enables us to build fine tools and special purpose machines to exacting requirements. Avail yourself of the industry-wide experience of Columbus Die-Tool.



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variables. Employing electronic servo-operated measuring systems, the instruments record with high accuracy while providing sufficient torque to operate a variety of control devices such as switches and slidewires. Includes product photos, application data, typical control system schematics, specifications, and dimensions.

12 CARBIDE MINIATURE REAMER —*Microtron, Inc, 6 Manhasset Ave, Port Washington, NY.* Illustrated bulletin gives information on tool that can be sized with extreme accuracy in a very short time. Available in 1/16 and 1/32 in. (overall lengths, 1¼ in. and 1 in.; length of cutting edges, 5/8 and ½ in. respectively). Microtron sizing hone available.

HEAT TREATING AND WELDING

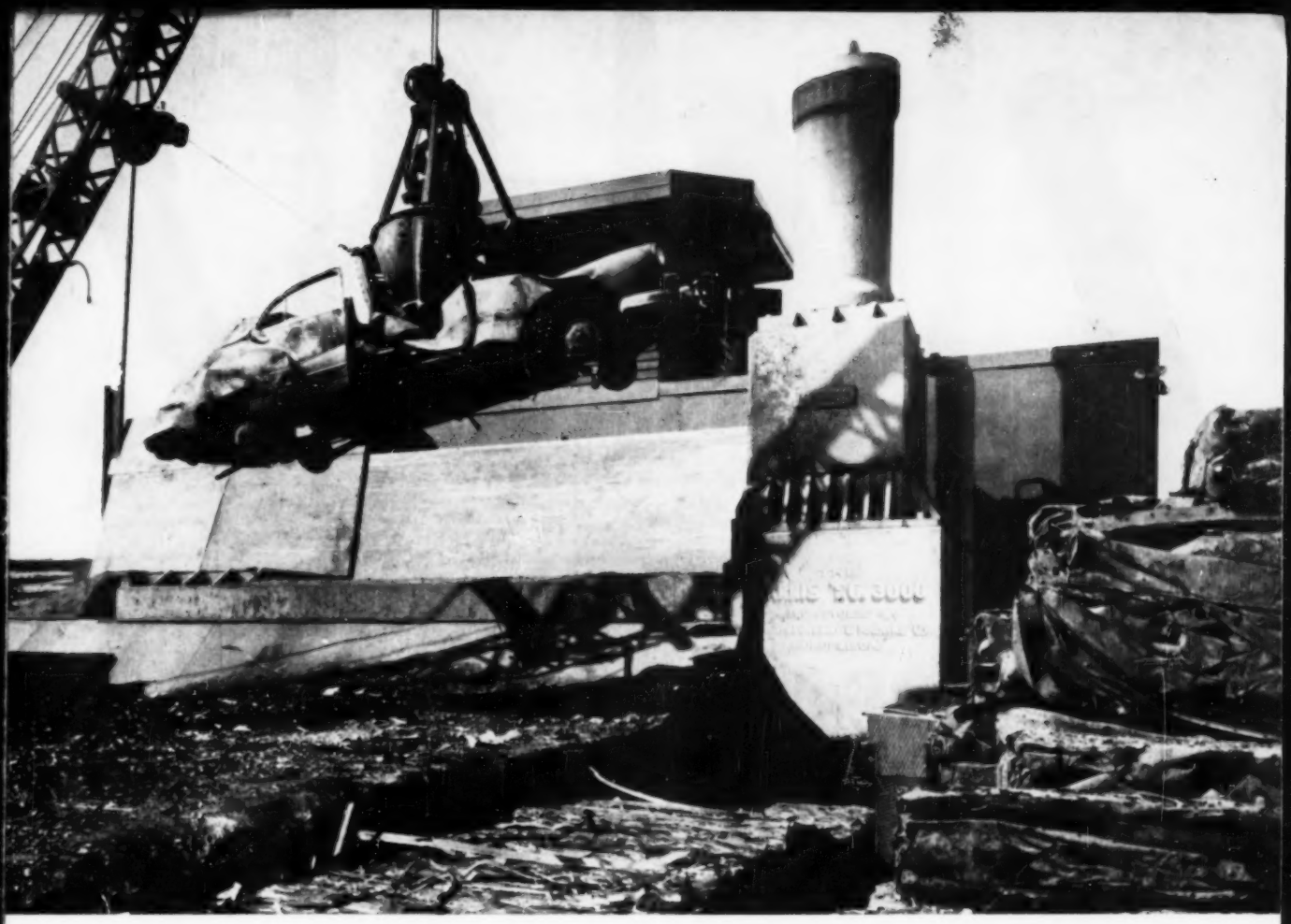
13 ALUMINUM WELDING—*Air Reduction Sales Co, 150 E 42nd St, New York 17, NY.* 120-page spiral-bound book is a comprehensive survey of the techniques of welding aluminum using AR's Aircomatic (gas-shielded metal-arc) and Heliweld (tungsten-inert-gas) processes. Major topics covered include weldability of aluminum and its alloys; definitions and technical discussions of the two processes; selection of the proper process for certain job applications; descriptions of manual and automatic equipment; welding power supplies; safety practices. Book is illustrated with 100 photos, charts, and detailed diagrams of Aircomatic and Heliwelding equipment and techniques.

14 WELDING MACHINES — *Sciaky Bros, Inc, 4915 W 67th St, Chicago, Ill.* Bulletin 318-1 describes Type SPT-2 spot welder and EPT-2 projection welder; both are air-operated, press-type, 3-phase. In addition to illustrated descriptions of the machines, brochure describes tooling required to convert the EPT-2 from projection to spot welding. Machine data is tabulated to indicate KVA range, throat depths, welding capacities, and electrode forces.

15 ATMOSPHERE HEAT TREATING —*Ferrotherm Co, 1861 E 65th St, Cleveland 5, Ohio.* Illustrated case histories show applications of heat treating in hydrogen and other protective atmospheres

(Continued on page 141)

"I sometimes wish a machine would replace me!"

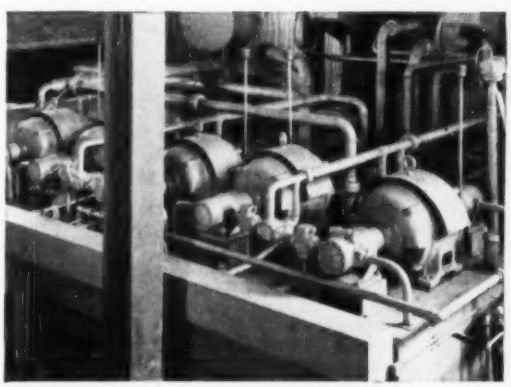


Smashing ¾ ton autos into 5 ft. bales

In a scrap salvage yard in Chicago, this huge press smashes automobiles into five-foot bales. Here's how it works. Stripped autos are shoved into a 20-foot press box. At the flip of a switch three giant plungers jam down with a force of over 1000 tons. Result: A compact bale, five feet long and two feet deep. About 30 cars an hour are run through this giant baling press.

Powering this mammoth machine requires sturdy motors. They have to deliver an instantaneous surge of power to drive home the huge plungers. Five Century Electric 100 hp motors do the job. Result: Plenty of dependable power when and where it's needed.

Century Electric application engineers have helped develop thousands of motor drive systems like this. And they can design the right drive system for your equipment because Century Electric designs, manufactures and applies motors and nothing but motors . . . your assurance of getting *more* than just a motor.



Five 100 hp Century Electric motors provide dependable muscle power for the huge press.

CENTURY ELECTRIC COMPANY

St. Louis 3, Missouri *Offices and Stock Points in Principal Cities*

Century

59-9

CIRCLE 259 READER SERVICE CARD

In 6 steps with Bethlehem cold-heading wire

Using Bethlehem C4037 heading-quality wire, this ¼ by 4-in. socket-head cap screw is produced in six quick steps:

1. Cut off blank
2. Bulbing
3. Heading
4. Extrusion
5. Trimming
6. Roll threading and knurling

The whole sequence is performed "cold." And it produces a cap screw free from the surface weaknesses of machined parts. Scrap loss is minimized because virtually the whole blank is utilized in the finished screw. Cold-heading wire is usually more economical than screw-machine stock; savings often come to 10 pct and more.

Bethlehem makes just about every kind of heading-quality wire. Manufacturing is rigidly controlled. Frequent mill tests assure proper surface quality, chemical composition, and internal soundness.

One of our engineers will gladly study your wire products—cold-headed or other—and recommend the grade of steel best suited, quite possibly with improved results. Just phone the nearest Bethlehem office, or write to the address below.

BETHLEHEM STEEL COMPANY
Bethlehem, Pa.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation.
Export Distributor: Bethlehem Steel Export Corporation

BETHLEHEM STEEL

BETHLEHEM STEEL

CIRCLE 260 READER SERVICE CARD

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on such processes as cycle annealing, furnace brazing, stress relieving, solution heat treating, precipitation hardening, on such materials as 347 and 304SS, Vascojet, A-286, 17-4 and 17-7PH, beryllium, Inconel. Also describes applications of simultaneously brazing and hardening of aircraft stainless parts and heat treatments of nuclear components.

PLANT SERVICE EQUIPMENT

16 FINISHING PROCESSES — *Roto-Finish Co, 3700 Milham Rd, Kalamazoo, Mich.* 30-page catalog on precision mechanical finishing and automatic finishing processes outlines in detail the various types such as grinding, deburring, descaling, and polishing. Illustrations and descriptions of the various conventional models, as well as the Roto-Matic automatic finishing machine are included, plus the newly developed Vibratron which employs a vibratory abrasive action. Dimensions, capacities, recommended usage of the various types of equipment are supplied, as well as data on abrasive chips and compounds.

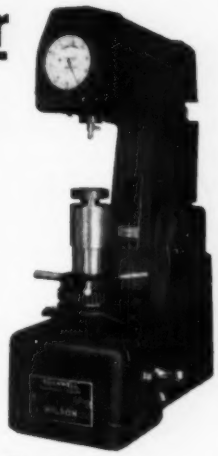
17 SERVICE VEHICLES—*Gerske Industrial Equipment, 132 E 30th St, Indianapolis, Ind.* 4-page bulletin contains illustrated description of self-propelled Scavengers and Coolant Servicers, materials handling and plant maintenance machines. Applications and specifications included.

18 METAL PARTS FINISHING COST GUIDE—*Apollo Metal Works, Dept AM-3, 66th Place & S Oak Park Ave, Chicago 38, Ill.* 6-page folder, applicable to manufacturers of products fully or partially fabricated from metal, is designed for determining and comparing costs involved in metals finishing procedures 1) on-premises finishing of parts; 2) off-premises; and 3) use of pre-finished metals. Comparative figures are confined to the individual operation or sequence of operations for which the guide is used. They take into account not only raw material prices, but also hidden costs and unrecognized expenses that are frequently overlooked when comparing metal finishing costs.

19 TUMBLING BARRELS AND COMPOUNDS—*Tumb-L-Matic, Inc, 10 St Mary's St, Stamford, Conn.* Data file contains information on complete line. 14 single-page insert sheets cover specific types of barrel unit, tumbling medium, or finishing process.

"You're getting warm."

One of these Wilson "Rockwell" instruments will do your hardness testing job



No matter what your hardness testing requirements are, there's a Wilson "Rockwell" tester to do the job. Choose from this complete selection of hardness testing equipment:

"Rockwell" Hardness Tester—for most hardness testing functions.

"Rockwell" Superficial Tester—for extremely shallow indentations.

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Special Machines—for testing large objects, internal readings, and other unusual applications.

Diamond "Brale" Penetrators—Flawless diamonds, individually calibrated, and highest quality construction assure perfect testing every time.

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WILSON "ROCKWELL" HARDNESS TESTERS

ACCO

Wilson Mechanical Instrument Division
American Chain & Cable Company, Inc.
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CIRCLE 261 READER SERVICE CARD

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AUTOMATIC TAPPER

- NO SKILLED OPERATOR REQUIRED
- ADJUSTABLE TORQUE
- SAVES UP TO 90 PER CENT ON TAP BREAKAGE

Yes, and in addition, production time reduced to 1/10th that previously required by the drill press method was reported by a leading West Coast electronic component manufacturer. This is the story of the Milman Multiple Pitch Automatic Leadscrew Tapping Machine. A small, high speed, sensitive tapper that can be operated by an unskilled operator or incorporated in an automatic manufacturing line, it will handle all the small hole problems encountered in the manufacturing of delicate parts requiring extreme accuracy. It can guarantee class 3 threads. This highly versatile unit, built to instrument standards, can be used in through or blind hole tapping of all thread sizes from 000-120 through 10-32 in all types of workable materials.

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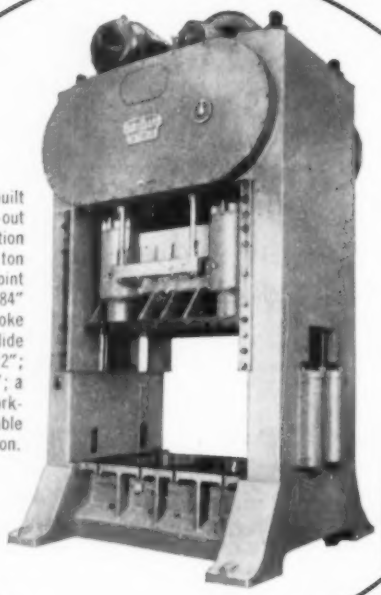
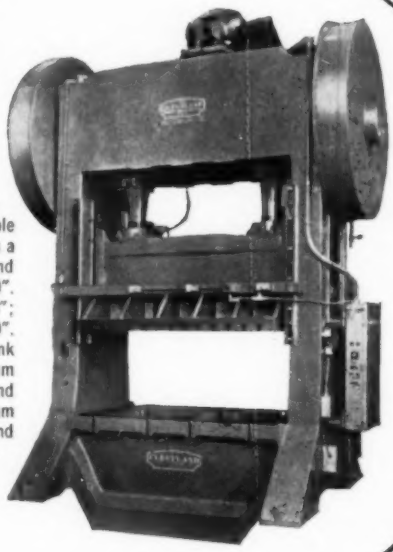


Ruggedly built for day-in, day-out steady production—this 400-ton Cleveland 4-point Press has a 60 x 84" bed area; stroke of slide, 18"; slide adjustment, 12"; shut height, 54"; a dependable work-horse for profitable production.



This 300-ton Straight-Sided Double Crank Press has a 60 x 84" bed area and shut height of 40". Stroke of slide, 18"; Slide adjustment, 10". This double crank press offers maximum accuracy and die life—minimum maintenance and per-part cost.

SINCE 1880

CLEVELAND PUNCH & SHEAR WORKS CO.

Pioneers in Cost-Cutting Metalworking Presses, Fabricating Tools.

Here's how they pay for themselves!

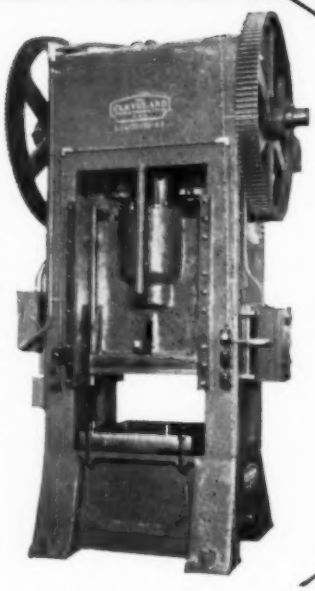
CLEVELAND PRESSES

INCREASED PRODUCTION • ECONOMY OF OPERATION • MINIMUM MAINTENANCE

Each of these Cleveland Presses features the patented Cleveland Drum Type Friction Clutch—easily adjusted, uses less power, assures minimum down-time. For lower operating costs, it provides quicker starting and stopping to boost production.

For proven metalworking economy, Cleveland has 12 different types of presses: Inclinable, Horning, Gap, Trimming, Knuckle-Joint, Toggle, Straight Sided Crank, Straight Sided Eccentric, Single Point, Two Point, Four Point, and Four Point Underdrive—each in a wide range of capacities, bed areas, stroke of slide, etc. Investigate how you get BETTER stampings for LESS with a Cleveland Press.

AA 9018



This Cleveland 200-ton Straight Sided Single Crank Press is ruggedly built to meet your trimming, blanking, drawing and other press needs. Bed area, 42 x 36"; stroke of slide, 12"; slide adjustment, 6"; shut height, 26".

THE CLEVELAND PUNCH & SHEAR WORKS CO. U.S.A.
Established 1880

Power Presses
Fabricating Tools
Punching Tools & Dies

E. 40th and St. Clair Avenue, Cleveland 14, Ohio

Irwin W Killian, executive vice president of Pines Engineering Co, Aurora, Ill, has been elected president and chief executive officer. He succeeds **B F Bower** who died May 5

M J Steffes, vice president of Super Tool Co, cemented carbide tool manufacturing division of Van Norman Industries, Detroit, has been elected executive vice president

NAMES IN THE NEWS...

Howard R Hammond has been appointed general manager of the newly created Defense Products Division, Allis-Chalmers Manufacturing Co, Milwaukee. He was formerly associated with Food Machinery & Chemical Corp, San Jose, Calif, as manager of application engineering, Ordnance Division. **William H Davis** has been named assistant manager of the Norwood (Ohio) Works electrical department. He was formerly manager of products sales there.

Ernest A Siemssen, formerly production manager, has been appointed chief engineer, Automatic Machinery Division, Selas Corp of America, Dresher, Penna. He will be responsible for designing custom-built machines for heat processing metals.

Robert F Shannon has been named general manager of the Detroit Sintered Metals Corp, Kalamazoo, Mich, subsidiary of Bunting Brass & Bronze Co, Toledo. He succeeds **Henry F Latva,** transferred to the Toledo office on special assignment. Mr Shannon was formerly associated with P R Mallory Co of Indianapolis in charge of manufacturing operations at the Mallory-Sharon Metals Division at Huntsville, Ala.

Bert E Phillips has been appointed acting general manager of Clark Equipment Co's Industrial Truck Division, Battle Creek, Mich. He succeeds **Robert H Davies** who has resigned to become president of Electric Auto-Lite Co. **John E Mitchell,** general manager of the New York City factory branch, has been named general sales manager of the division, the post formerly held by Mr Phillips.

Harry K Smyth, vice president of Saco-Lowell Shops, and assistant general manager of both its Textile Machinery Division at Easley, SC, and the Gear and Machine Division at Sanford, NC, has asked to be relieved of his operating duties because of ill health. He will continue as a company vice president. **Royden Walters,** Boston-based S-L vice president, has been appointed executive vice president and assistant general manager of both the Easley and Sanford operations. **Henry A Jewel,** director of procurement and material control at Boston, has been named works manager at Easley. **Howard J Haug,** manufacturing manager at Sanford, has been made works manager.

R P Schmidt has been named manufacturing manager and **H J Little** production superintendent at Chrysler Corp's new McGraw Glass Plant in Detroit. Mr Schmidt has been manager of manufacturing services for the company's Parts and Equipment Manufacturing Division. Mr Little was formerly plant superintendent for the Guardian Glass Co, Detroit.

F L LaQue, vice president and manager of the Development and Research Division of International Nickel Co, has been elected president of the American Society for Testing Materials. **Miles N Clair,** president of Thompson & Lichtner Co, has been elected vice president of the Society.

J J Dall has been appointed assistant general manager, electric welding, Linde Co, Division of Union Carbide Corp, New York. Mr Dall has been associated with Linde in various capacities since 1946.

Gilbert Tint has been appointed vice president and chief engineer of National Ultrasonic Corp, Irvington, NJ, manufacturer of ultrasonic cleaning and testing equipment. Prior to joining the company Mr Tint was chief engineer for Alcar Instruments, Inc, Little Ferry, NJ.

John B Darrah has been named vice president and general manager of the Defense Division of Budd Co, Philadelphia, Penna. He has been serving as assistant works manager in charge of dies, jigs, and fixtures.

John R Eastman, chief engineer at Sterling Electric Motors, Los Angeles, has been elected vice president, engineering. **William E Hoppock,** factory manager, has been named vice president, manufacturing.

Donald J Wallace of the Wheel Trueing Tool Co, Detroit, has been elected president of the Industrial Diamond Association of America, Inc, Pompton Plains, NJ. **Bernard Jolis,** US Industrial Diamond Corp, New York, has been named first vice president, and **Leopold H Metzger,** Super-Cut, Inc, Chicago, second vice president.

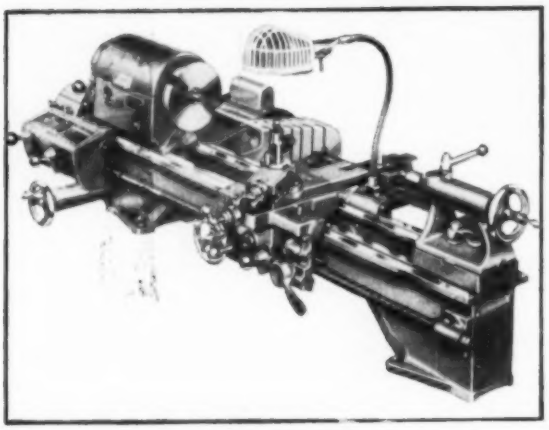
Edward O Falberg has been appointed division manufacturing manager of Bohn Aluminum & Brass Corp. He will be responsible for manufacturing operations of two of Bohn's plants, the bearing manufacturing unit at Greensburg, Ind, and the extrusion, forging, and decorative trim facility at Holland, Mich. **Carl F Brown** takes over Mr Falberg's former duties as plant manager at Greensburg. He had been assistant there.

David F Robinson has been named general manager of Machine Tool Sales Co, a Division of Tool Supply & Engineering Co, Dallas, Texas. Prior to joining the company Mr Robinson was a member of the sales staff of Giddings & Lewis Machine Tool Co, serving in the eastern office.

NEW

from

DELTA



10" METAL LATHE

can't be matched for real value!

No other lathe on the market offers you this exclusive combination of important features *as standard equipment:*

- **VARIABLE SPEED DRIVE**
- **¾" COLLET CAPACITY**
- **DOUBLE ROW BALL BEARING (INBOARD)**

And only Delta, with its modern production facilities, can give you so much lathe for so little money—only $645.00. If you want unequalled value in precision, ruggedness, and safety, get all the facts about this great 10" lathe value.

NEW LATHE CATALOG

Pictures and describes the new 10" lathe plus complete line of Delta Metal Lathes and full range of accessories. For free copy and list of Delta Lathe Dealers write: Rockwell Manufacturing Company, 618-F, N. Lexington Avenue, Pittsburgh 8, Pa.

DELTA METAL LATHES

another fine product by

ROCKWELL

New Dual Purpose Synthetic Grinding and Cutting Compound

only synthetic that incorporates extreme pressure properties and leaves oily film on work

DUAL PURPOSE

Kerns' new SGC-6560 Compound will cover more applications than any product yet introduced to the metalworking industry. Scientifically developed for all grinding operations, Kerns' exclusive formulation contains excellent anti-weld qualities plus superior E. P. characteristics that make it equally suitable for cutting operations.

LONGER LIFE

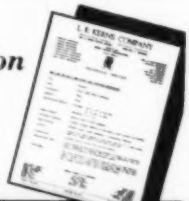
Tests show 4 times the sump life of other products . . . this long life saves cash dollars and assures a minimum of downtime plus increased production.

CLEAN . . . SAFE

Kerns' SGC-6560 completely eliminates rancidity and skin irritation. Being transparent when in solution, it produces cleaner work and provides superior rust protection. It will not dry out on gauges, ways or moving parts, and will never cause sticking or impair operation of machines.

MEMO BILLING TRIAL BASIS

Try it . . . we supply material for production test . . . no formal invoice rendered unless completely approved in production. Remember . . . with Kerns you get compounds tailored to *your* operation.



Write for further information and Technical Data Sheet SGC-6560.

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SERVICE

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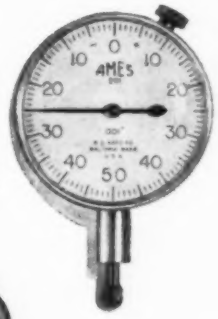
A transistorized portable comparator for fast accurate measurement in both "tenths" and "thousandths" scales.

MODEL AG AIR GAUGE
For checking diameters, dimensions, roundness, etc.

200 SERIES MICROMETER DIAL INDICATOR
One of four sizes. Made to AGD specifications.



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For desk, bench or at-the-machine inspection of small parts.

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Masters of Measurement...

For more than half a century, Ames measuring instruments have been regarded as the finest made. Today the constantly growing line of Ames indicators, gauges, micrometers and comparators includes such amazingly accurate instruments as the new Ames "PORTA-CHECK", an electronic comparator which gives accurate readings *in millionths of an inch*; and the new Model AG air gauge—also accurate to millionths of an inch. Wherever precision is *really* important . . . you'll find Ames "masters of measurement" on the job.

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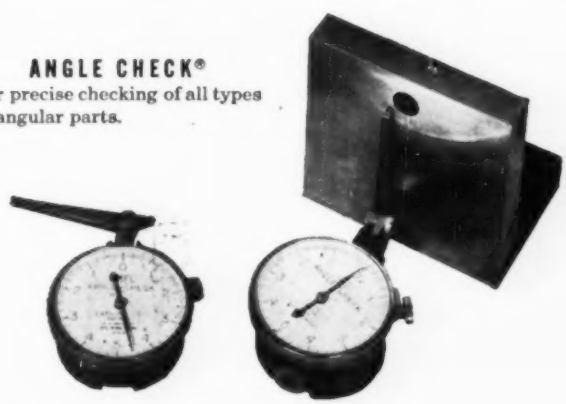
ANGLE CHECK®
For precise checking of all types of angular parts.



Verson

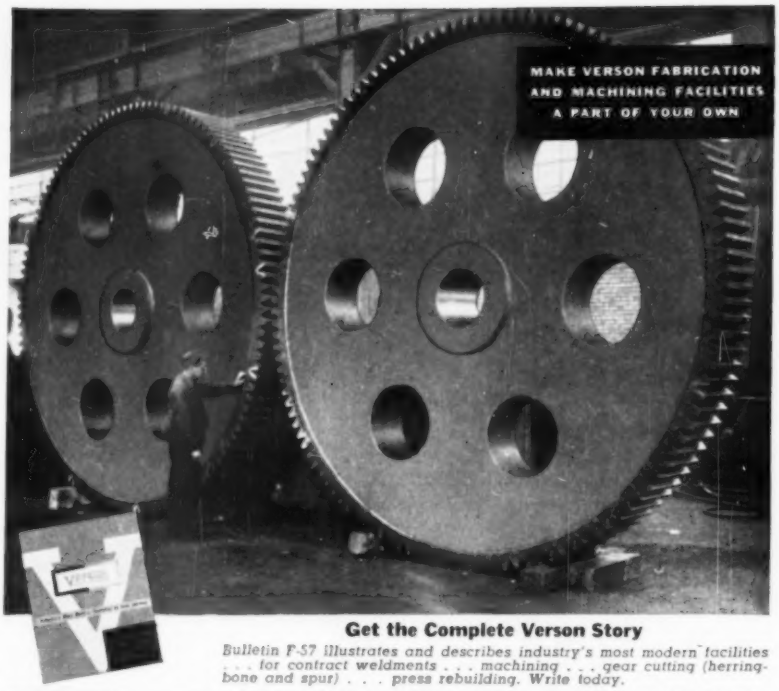
can handle

"THE BIG ONES"

The gears you're looking at have an O.D. exceeding 13 feet . . . were fabricated complete in Verson's Chicago plant. Teeth were flame cut, with stock allowed for finish machining.

Such jobs require big tools and industry's most modern facilities. Such jobs are typical of work turned out daily by the Contract Fabricating and Machining Divisions of Verson Allsteel Press Co.

Faced with a job you can't handle? Facilities tied up on other work? Requirements exceed the capacities of your machines? Many manufacturers in this spot find Verson's contract setup the answer to their problems. Perhaps we can solve yours, also. Whatever your needs, it will pay you to talk to Verson first. No obligation.



Get the Complete Verson Story

Bulletin F-57 illustrates and describes industry's most modern facilities . . . for contract weldments . . . machining . . . gear cutting (herringbone and spur) . . . press rebuilding. Write today.

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MECHANICAL AND HYDRAULIC PRESSES AND PRESS BRAKES • TRANSMAT PRESSES
TOOLING • DIE CUSHIONS • VERSON-WHEELON HYDRAULIC PRESSES

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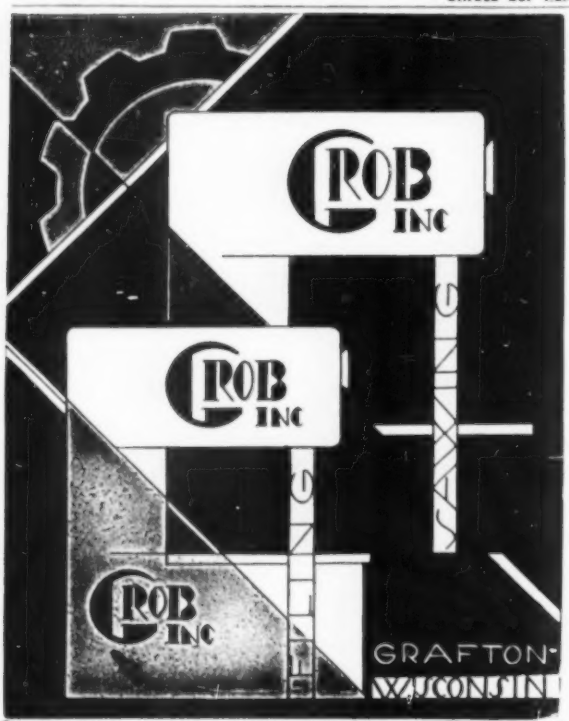

Machines for Filing, Sawing, Gear & Spline Rolling.

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RIVETERS — PIONEERS in their line — head rivets from smallest to ¾" diameter either by NOISELESS SPINNING or VIBRATING HAMMER method — Sizes to meet all needs — Types include Vertical and Horizontal Multiple Spindles.

Write for literature and don't forget to send samples.

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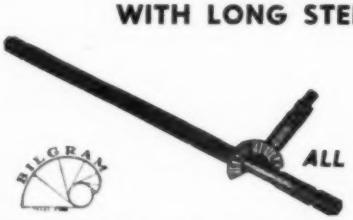
BEVEL GEARS AND BEVEL PINIONS WITH LONG STEMS



BILGRAM

ALL TYPE GEARS

BILGRAM GEAR & MACHINE WORKS

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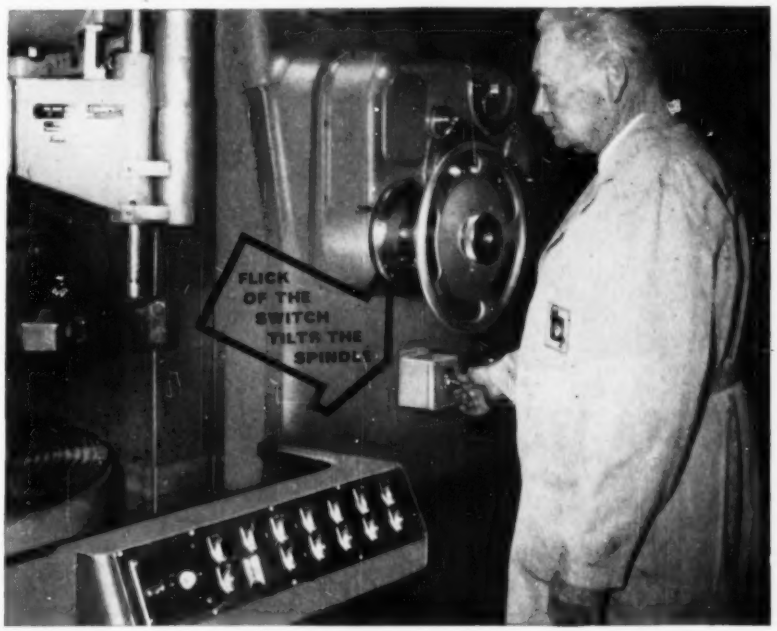
MATTISON
HIGH-POWERED PRECISION
GRINDING METHODS

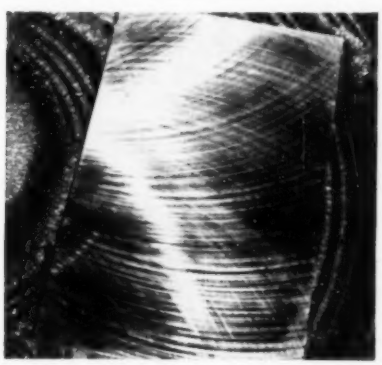
Quick-Tilt grinding—difference between a hogging cut and "going whole hog"

Mattison's No. 24 and 36 rotaries with Quick-Tilt spindle combine high stock removal and dead flat finish. New grinding method reduces direct and indirect costs simultaneously.

Now, you can rough and finish on one machine . . . in one setup, without costly downtime for resetting the spindle. On a Mattison rotary with Quick-Tilt spindle, you rough out the workpiece using the leading edge of the wheel, increasing grain penetration and stock removal. Then, a flick of the switch and you're set for finishing. A fast spark-out and every piecepart, under the center of the wheel or the outer edges, comes off with perfect cross-hatching that characterizes a dead flat surface (see illustration) and uniform dimensional accuracy.

This dual cycle means an increase in production of 50% or more. You can do more work better with a smaller inventory of wheels. What's even more important . . . you can reduce hidden costs because wheel-loading and heat-checking are eliminated. Downtime for changing and dressing wheels is minimized.





Behind Quick-Tilt . . . a machine that stays put

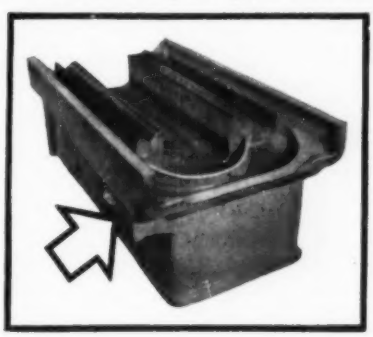
To give you savings like these, Mattison has combined the Quick-Tilt spindle and high horsepower (60 on the No. 24 and up to 100 on the 36), and backed them up with a heavy, rigid machine. Only on a Mattison do you get these four *big* advantages:

1. Massive full-length column—One-piece casting from the floor up eliminates deflection when pulling maximum horsepower. This means less stock to remove during spark-out.

2. Longer, wider, thicker ways—Prevent cocking or binding under fine feeds and heavy loads.

3. Close-coupled head—Only the spindle tilts, not the column. Patented 4-point suspension distributes the load.

4. Heavy double-walled bed—Rugged cross-rib and flange design, constructed from the finest Meehanite metal . . . stress-relieved by heat-treating.



Bed design important

You can't get full production and accuracy from a high-powered surface grinder without something solid underneath to absorb heavy thrust from the table. That's why Mattison puts Meehanite in the base . . . not coolant. By keeping coolant in an outside tank, you avoid heat distortion and reduce downtime for cleaning. A 30-minute lunch break sees the job done.

Try it and see

Let us show you the savings possible on your own pieceparts. Ask your Mattison dealer to arrange a test grind in our Methods Lab . . . or, if you would prefer, phone the factory direct.

MATTISON MACHINE WORKS
Rockford, Illinois Phone WOodland 2-5521

MATTISON MACHINE WORKS
HIGH-POWERED PRECISION SURFACE GRINDERS

CIRCLE 271 READER SERVICE CARD

A new model of the MATRA High-Duty SS. and SC.-Lathes

suitable for maximum cutting capacity at highest degree of accuracy available at a height of centres from 300 to 400 mms (11¾, 13¾, 16") and a distance between centres from 1000 mms to 8000 mms (39"-to-26')

Model D 50

MATRA-WERKE · GMBH · 301
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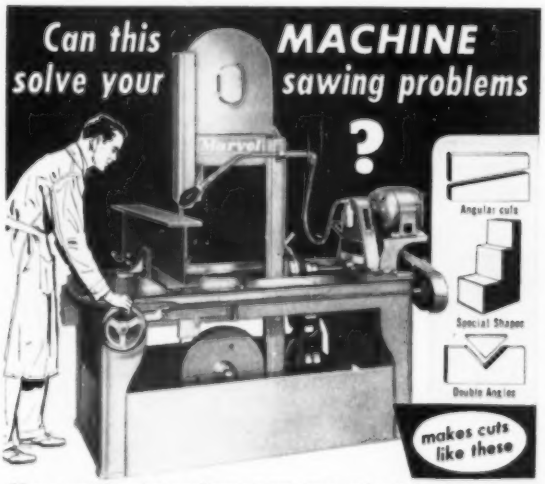

If your metal sawing requirements are many and varied . . . if you have to cut the smallest, most delicate work or heavy solids up to 18"x18" . . . if you cut-off bar stock, pipe, tubing, moulding or structural shapes—then this MARVEL No. 8 Band Saw is the machine for you.

Not only is the MARVEL No. 8 Band Saw a truly universal machine capable of handling virtually any metal sawing job, but it does its work with unmatched efficiency, economy, and ease of operation. Many exclusive No. 8 Band Saw design and operating features such as vertical column design, control tower visibility, column and blade tilting to any angle up to 45° right or left of vertical for cutting at an angle or miter, are described in Bulletin 875. Write for it today. If you'd like a demonstration, mention the fact in your inquiry, and we'll arrange it at your convenience.

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CUT SCRAPER TIME
END NIGHT CLEANUP & MORNING REBLUING

DYKEM HI-SPOT BLUE No. 107 is used to locate high spots when scraping bearing surfaces. As it does not dry, it remains in condition on work indefinitely, saving scraper's time. Intensely blue, smooth paste spreads thin, transfers clearly. No grit; noninjurious to metal. Uniform. Available in collapsible tubes of three sizes. Order from your supplier. Write for free sample tube on company letterhead.

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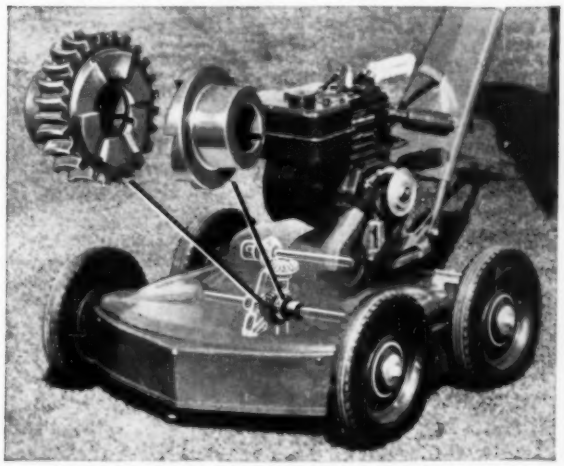
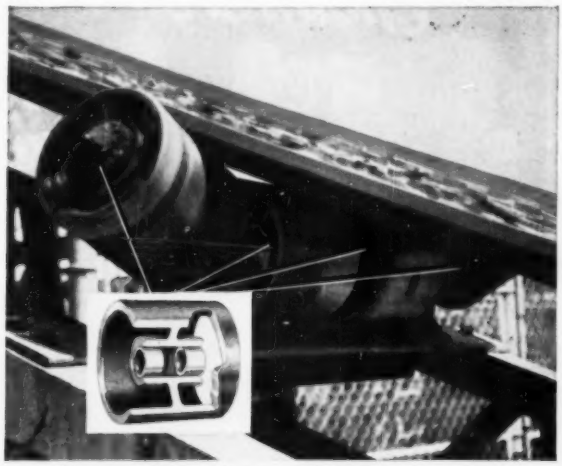
CIRCLE 275 READER SERVICE CARD

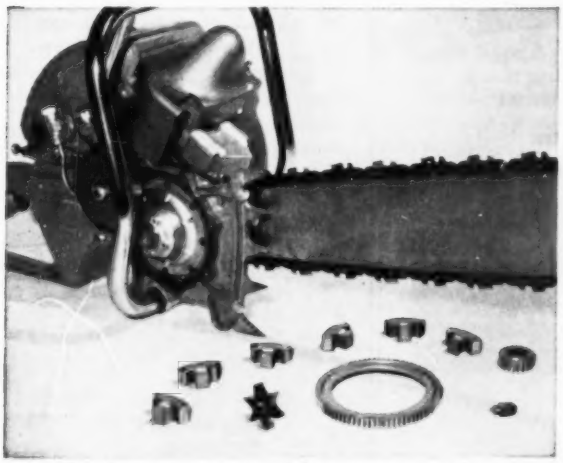
BOOST PRODUCT APPEAL with OILITE



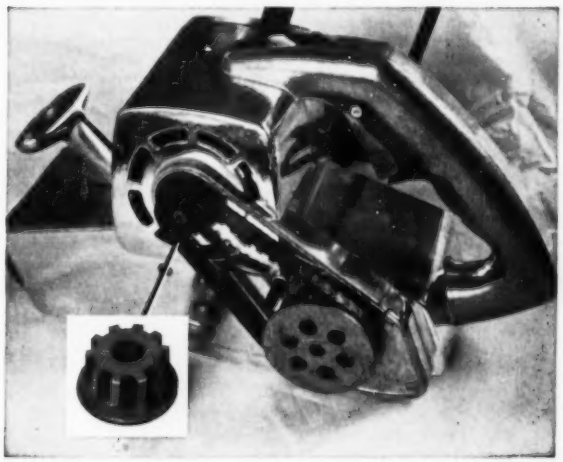
These 2 Oilite components now do the work of 4 former machined parts . . . contribute new economy, less upkeep.



Not one "squeak" from this conveyor . . . yet the dirt-encrusted Oilite bearings haven't been lubricated in 7 years.



Tough, wear-resistant Oilite gears, sprockets and clutch shoes keep costs low . . . make power saw more dependable.



The Oilite pulley of this heavy-duty belt sander provides yet another example of improved performance at less cost.

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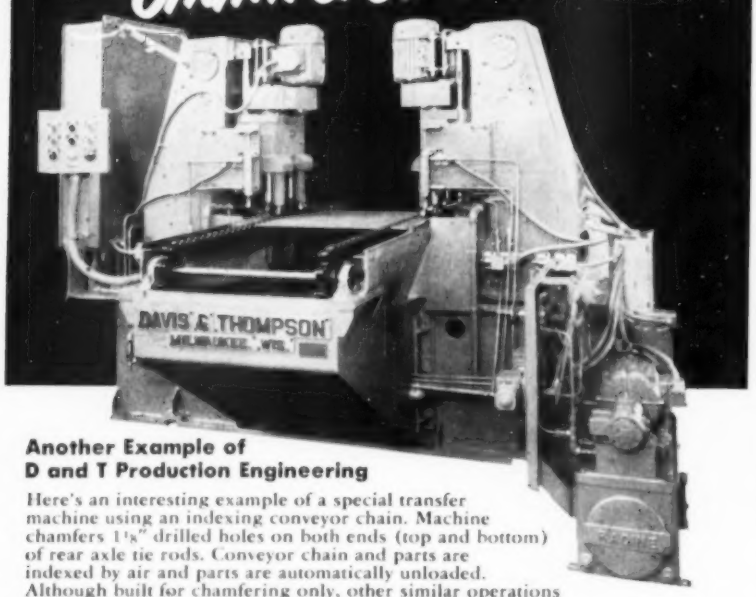

Another Example of D and T Production Engineering

Here's an interesting example of a special transfer machine using an indexing conveyor chain. Machine chamfers 1⅛" drilled holes on both ends (top and bottom) of rear axle tie rods. Conveyor chain and parts are indexed by air and parts are automatically unloaded. Although built for chamfering only, other similar operations can be incorporated on this basic machine design.

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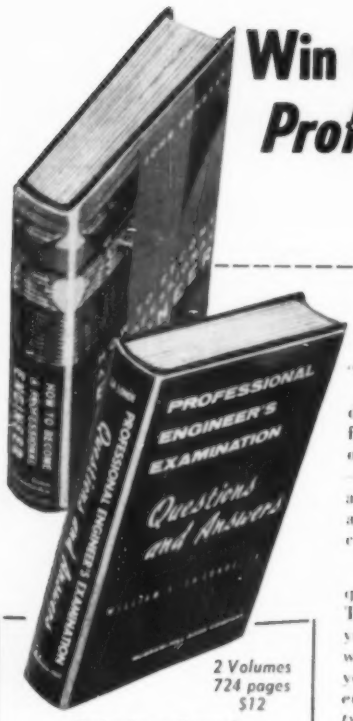

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2. Automatics
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6. Boring Mills
7. Broaching Machines
16. Drilling & Reaming Machines
24. Grinding Machines
29. Lathes
33. Milling Machines
37. Planers
40. Press Brakes
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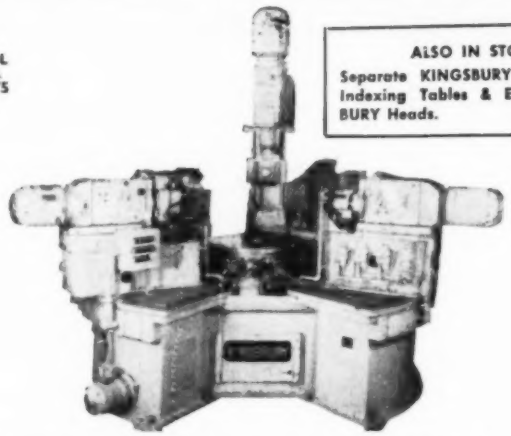

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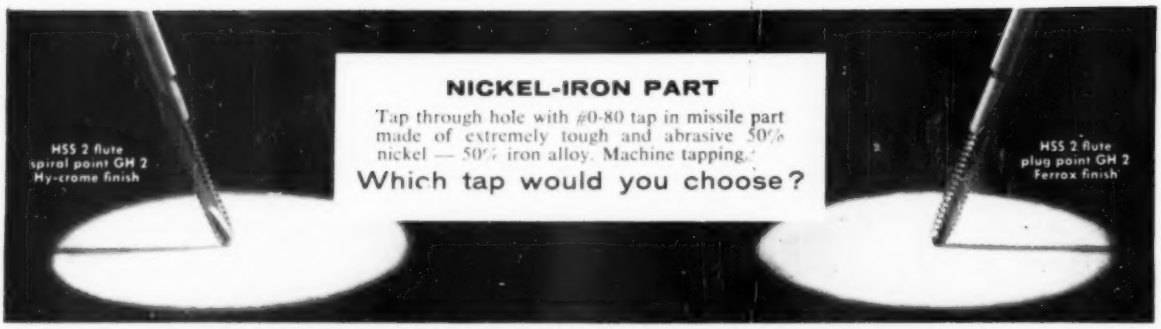
Check your skill in tap selection with this

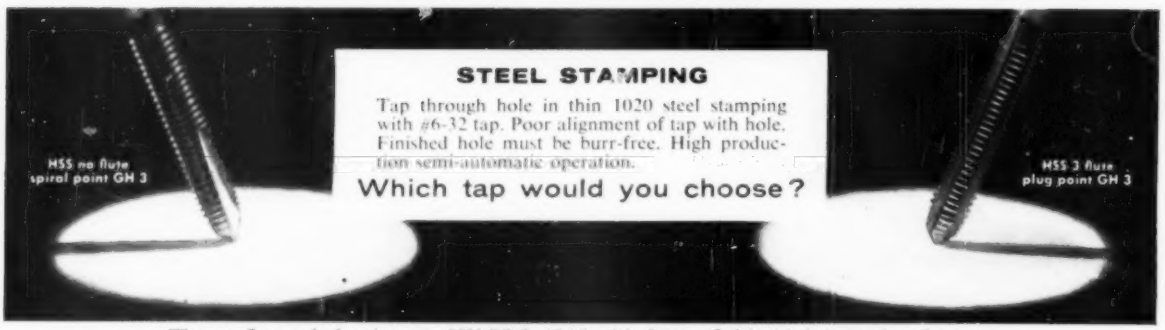
HY-PRO "TAP-nology" TEST


HSS 2 flute
spiral point GH 2
Hy-crome finish
NICKEL-IRON PART
Tap through hole with #0-80 tap in missile part made of extremely tough and abrasive 50% nickel — 50% iron alloy. Machine tapping.
Which tap would you choose?
HSS 2 flute
plug point GH 2
Ferrox finish

The HY-PRO #311 tap with Hy-crome finish (left) produced *5.7 times* the number of holes per tap obtained with the 2 flute plug tap.

HSS 2 flute
spiral point GH 7
bottoming
Nitride finish
PLASTIC PART
Tap blind hole with #8-32 tap in extremely abrasive high-temperature thermosetting plastic. Semi-automatic machine tapping operation.
Which tap would you choose?
HSS 5 flute
GH 7 bottoming
Hardernell finish

The HY-PRO #510-5 tap with Hardernell finish (right) produced *11.3 times* the number of holes per tap obtained with the 2 flute spiral point tap.


HSS no flute
spiral point GH 3
STEEL STAMPING
Tap through hole in thin 1020 steel stamping with #6-32 tap. Poor alignment of tap with hole. Finished hole must be burr-free. High production semi-automatic operation.
Which tap would you choose?
HSS 3 flute
plug point GH 3

The no flute spiral point tap. HY-PRO #315 with ferrox finish (left) produced up to *12.4 times* as many holes per tap as the 3 flute plug point tap.

Call your local
HY-PRO DISTRIBUTOR
for standard taps
FROM STOCK

If you picked the wrong taps, don't be surprised. Most tap users make similar errors, without realizing it, when they buy taps by "habit," instead of by comparative performance.

These examples show *how much it pays you* to be right about taps. Selection today takes more tap knowledge than ever, with so many new metals, alloys, and plastics in industrial use.

To make sure your "tap-nology" is up to the minute, consult HY-PRO tap engineering specialists. It costs nothing, and records prove it is often the first step to big savings. Write: Dept. B.

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501	508	515 522 529
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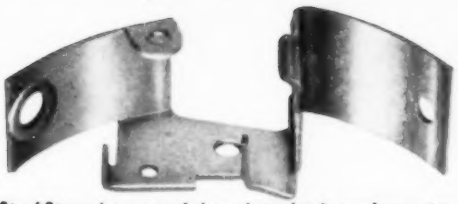
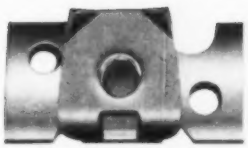
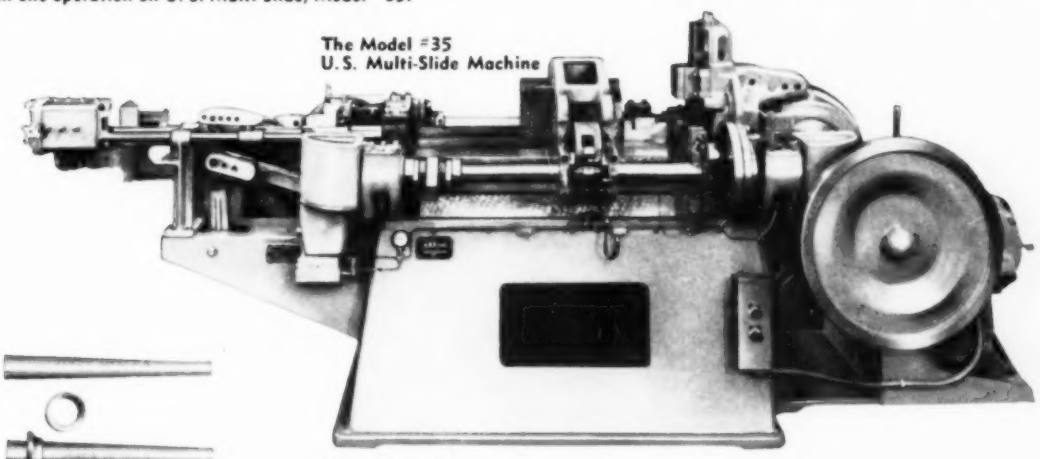


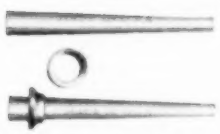
Steel Stamping, actual size, pierced, trimmed, countersunk, beaded and formed on various planes. Produced in one operation on U. S. Multi-Slide, Model #35.



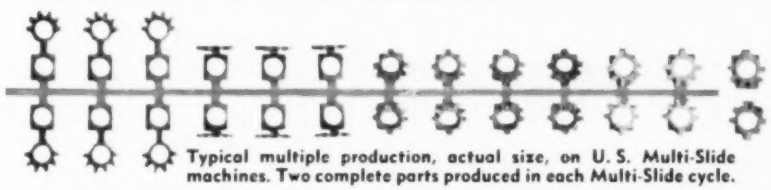
Brass Stamping, twice actual size, pierced, trimmed, formed, counter-sunk and tapped in one operation on U. S. Multi-Slide, Model #33.

The Model #35
U. S. Multi-Slide Machine





Aluminum conical tube, actual size, and shaped collar assembly. Both pieces produced and assembled simultaneously in a single cycle of U. S. Multi-Slide, Model #28.



Typical multiple production, actual size, on U. S. Multi-Slide machines. Two complete parts produced in each Multi-Slide cycle.

In a single U. S. Multi-Slide® cycle you can pierce — trim — countersink — bead — emboss — swage — tap — form — and assemble in almost any combination ● U. S. Multi-Slide "built-in motions" offer a practically unlimited variety of tooling possibilities. **In One Operation** you can produce components and assemblies that would ordinarily require multiple handling ● Stampings or assemblies produced on the U. S. Multi-Slide are consistently uniform and to required tolerances ● If you produce or purchase stamped components, investigate the cost saving potential of U. S. Multi-Slide machines. ● Ask for a copy of Bulletin 15-A or to compare manufacturing costs—send in samples or drawings of the part you want to produce.

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U. S. Multi-Slides™ • U. S. Multi-Millers™ • U. S. Automatic Press Room Equipment • U. S. Die Sets and Accessories

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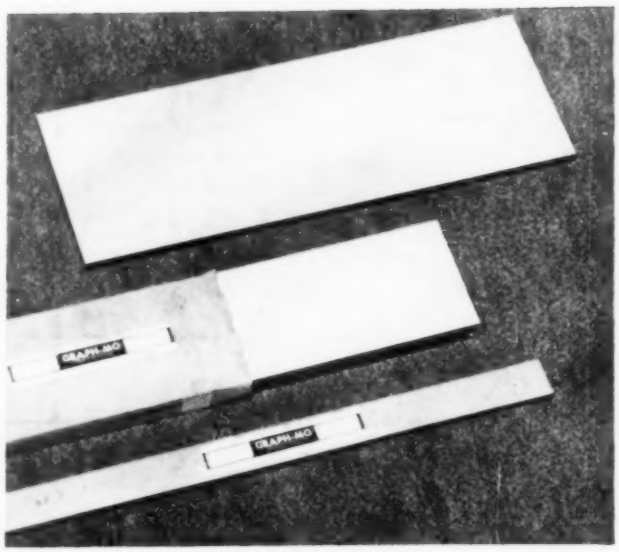
Get your stock list from our distributors or by writing direct. There is only *one* Graph-Mo, and the Timken Company makes it. The Timken Roller Bearing Company, Canton 6, Ohio. Cable address: "TIMROSCO". *Makers of Tapered Roller Bearings, Fine Alloy Steels and Removable Rock Bits.*



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